917
Pit/suc
84901

BOMBAY BRANCH
OF THE
ROYAL ASIATIC SOCIETY.
TOWN HALL, BOMBAY.

Digitized with financial assistance from the
Government of Maharashtra
on 07 April, 2016

A

SUCCINCT VIEW

AND

ANALYSIS

OF

AUTHENTIC INFORMATION

EXTANT IN ORIGINAL WORKS,

ON THE 1832

PRACTICABILITY OF JOINING

THE

ATLANTIC AND PACIFIC OCEANS,

BY

A SHIP CANAL

ACROSS

THE ISTHMUS OF AMERICA.

84901

By ROBERT BIRKS PITMAN.

X 9 37

LONDON:

Printed for J. M. RICHARDSON, No. 23, Cornhill; and
J. HATCHARD and SON, Piccadilly.

1825.

00084901

PREFACE.

INTELLIGENT and inquiring persons have frequently sought in vain for some easy means of reference to accurate information, in regard to the practicability of forming a navigable communication for ships, between the Atlantic and Pacific Oceans.

It is remarkable, that in the present age of diversified and extended knowledge, no single work comprises the numerous topics which are connected with this interesting question. M. de

"of cutting a canal across the Isthmus "of America." This deficiency appears the more extraordinary, on discovering, that much authentic and valuable information is extant upon the topographical and nautical features of the Great Isthmus, but blended with other subjects in voluminous works.

On an attentive examination of the authorities alluded to, the author found that a mere digest of them would leave many leading facts, as much unascertained, between opposing assertions, as if they were utterly unknown; he was, therefore, obliged to weigh the conflicting statements against each other, and to apply the preponderating evidence to the subject in its different bearings.

The difficulty of solving the question, convinced him of the necessity of publishing the result of his researches, that public opinion might determine whether

it is within the compass of human exertion to open a navigable passage between the two oceans.

Whilst considering whether it would be expedient and justifiable to excite public co-operation, as a direct test of opinion, his intentions were anticipated by the announcement, in the month of February 1825, of a plan for forming an Association to effectuate this magnificent design.

The attention of the world having been thus drawn to the project, the author has been induced to believe, that the present is a seasonable opportunity for placing before the public, in a compendious form, the information which he has collected and concentrated.

In the title, the work is announced as treating of the Isthmus of America generally; but, in arranging the divisions of the subject, it has been thought necessary to distinguish each

route, as a minor Isthmus, by the name of its particular province or district.

The authorities consulted have been quoted in their own words, that the reader may be enabled, without further reference, to form an opinion upon this great geographical question.

Those quotations have been made from the following works, namely: Dampier and Wafer in 1681; Sharp and Funnel in 1703; De Ulloa in 1726; Bryan Edwards in 1799; M. De Humboldt in 1803; Walton in 1817; Robinson in 1820; Hall in 1822; and Purdy in 1824.

TABLE OF CONTENTS.

	Page
Preliminary Observations	1
Topography of the Isthmus of Darien	7
Remarks on the Topography of the Isthmus of Darien.	14
Topography of the Isthmus of Panama	22
Remarks on the Topography of the Isthmus of Panama	45
Topography of the Routes in the Province of Choco, in the Kingdom of New Grenada	61
Remarks on the Topography of the Routes in the Province of Choco, in the Kingdom of New Grenada	65
Topography of the Isthmus of Tehuantepec	67
Remarks on the Topography of the Isthmus of Tehuantepec	82
Topography of the Isthmus of Nicaragua	92
Remarks on the Topography of the Isthmus of Nicaragua	114
On the Relative Elevation of the Two Oceans at the Isthmus of America	142
Remarks on the Relative Elevation of the Two Oceans at the Isthmus of America	144
Local Peculiarities of Winds and Weather of the Isthmus of America	154
Remarks on the Local Peculiarities of Winds and Weather of the Isthmus of America	170
On the Climate and Diseases of the Isthmus of America	175

Page

Remarks on the Climate and Diseases of the Isthmus of America 189

On the Application of Mechanical Agency to a Canal-Navigation across the Isthmus of America 191

Comparative Review of the Topographical and Nautical Facilities of the several Isthmuses of Tehuantepec, Darien, and Nicaragua 198

On the Commercial and Political Consequences of intersecting the Isthmus of America with a Ship-navigation 223

On the Arrangements necessary to effectuate the proposed Design 226

MAP
of the
ISTHMUS of AMERICA

Exhibiting the five Routes for a Ship Canal between the

Atlantic & Pacific Oceans,

Examined in A Journey over the Country in that direction

by R. B. PITMAN.

The Red lines denote the proposed positions of the five Routes

A

SUCCINCT VIEW,

&c. &c. &c.

THE nations which are most interested, both locally and commercially, in the execution of the magnificent design of joining the two oceans at the Isthmus of America, appearing by recent measures to be actuated by liberal principles of international policy, a belief is naturally encouraged, that the time is arrived for determining whether this long contemplated and important project, which since the year 1513 has occupied every mind, is or is not practicable. For this reason it has been thought necessary to collate all extant authorities upon the subject. An impartial opinion may thus be formed whether it is a just cause of reproach, that, after the lapse of three hundred years, there neither exists a survey of the ground, nor an exact determination of the positions that are necessary to the accomplishment of a design, which is not merely important to the

present inhabitants of the earth, but which would be the means of spreading the sources of industry and happiness over those extensive and fertile regions bordering on the Pacific Ocean.

Every circumstance and consequence of this noble design is worthy of all governments that are occupied with the true interests of mankind: but it is especially within the obligations and power of Great Britain to investigate the subject impartially, and, if practicable, to accomplish an improvement upon the predispositions of nature, which, in pre-eminently benefiting herself, would confer inestimable advantages upon the rest of the world.

To promote the due consideration of a subject so extensive, and as yet so imperfectly understood by a large proportion even of those who discuss it, the first object of this work will be, to place in *juxta* position the miscellaneous information, and the contradictory observations and opinions which are extant in the writings of various statistical authors, that each may be more justly appreciated—that the subject may be cleared as far as possible of extraneous matter,—and that the examination may be limited to the points and questions which are really interesting, and likely to be generally useful to all nations.

Sound results may be obtained from the proposed comparison, to warrant those persons who shall associate for the execution of the design, in soliciting the protection, and the powerful example and mediation of the British Government, for the purpose of forming, with all other maritime nations, a convention, which would be as honourable to human nature, as it is unexampled; namely, a convention, by which war and its hideous consequences should, by common consent, be for ever excluded from that one spot on the earth's surface which appears destined by Nature to be the heart of the commerce of the world, so soon as the obstruction that impedes its action shall have been removed.

Such being the objects of this work, it is obviously as superfluous, as it would be uninteresting, to enter upon the examination of those very extensive routes that have been traced across certain interior provinces of North and South America, where it has been conceived possible to connect navigable rivers by means of canals adequate to boat navigation; as works of that nature can only be locally interesting, and must be very limited in their effects.

The transhipment of goods, the change of responsibility, and the pillage consequent upon

the employment of native and other persons entrusted, together with the delays, expenses, loss of markets, and injuries to quality, attendant upon placing merchandize in *entrepôts*, are so hazardous and injurious to the susceptible interests of commerce, that it has been uniformly found that a navigation, however circuitous, is preferable to a trade by *entrepôts*.

This single fact is a sufficient reason for restricting the examination to a very few of the nine routes which the learned and indefatigable Baron De Humboldt points out as offering probable lines for the construction of canals or for river navigation. That author truly observes, "however easy the carriage may be across the "mountains, no communication will ever result "from it, comparable to that opened from sea "to sea;" by which we are to understand in a broad sense, a navigation adequate to the passage of sea-going ships. But as it is necessary, for the better information of the public, to examine the whole Isthmus of America, lest a selection of any particular route should be thought partial or deficient, this work comprizes in its view all the known routes across the Isthmus, being five in number, though some of them ought, in strictness, to be excluded, as from their natural defects they cannot be made adequate to ship navigation.

Those five selected routes do not, however, correspond exactly in every instance with five of those specified by De Humboldt, because the Isthmus of Panama appears, on attentive consideration, to require being divided into two routes: that of Panama, properly so called, and that of Darien; as a material distinction exists between them, though at different periods each has been successively comprehended under the name of the other.

The following are the five selected routes. *First,* the Isthmus of Darien; *second,* the Isthmus of Panama; *third,* the Province of Choco; *fourth,* the Isthmus of Tehuantepec; and *fifth,* the Isthmus of Nicaragua.

They are classed in this order, though it is not exactly in accordance with geographical proximity, because it is the order of time in which they severally appear to have attracted the notice of travellers and of local authorities. By this arrangement, the observations upon the first named routes will have a useful bearing upon the others, which have not yet been so fully examined. For which reason the Isthmus of Panama, although it has very limited capabilities for being intersected by a ship canal, even if there are continuous levels in that direction, furnishes a standard of comparison, and topics of argument, applicable to such of

the other selected routes, as may be less subject to similar impediments.

It is not, however, in blind submission to any prevalent opinion, nor even by inference from the fact of navigable waters issuing from or penetrating deeply into the Isthmus of America at those five selected routes, that they are made exclusively the subject of this work. In confirmation of the choice, there is satisfactory evidence, which shews that the intermediate districts of the Isthmus, besides being devoid of navigable waters, or of suitable ports, and being of greater breadth, are longitudinally divided by continuous ridges of higher mountains than any of those which cross the five selected routes. And there is good authority for believing that the mountains are not only much lower in height at the proposed routes, but at some of them are actually interrupted by chasms, which seem to favour the construction of a ship canal.

TOPOGRAPHY OF THE ISTHMUS OF DARIEN.

THAT part of the great Isthmus of America which is peculiarly called the Isthmus of Darien, is bounded by the gulf of Darien, which opens into the North Sea, and by the gulf of St. Michael, which opens into the Bay of Panama near Point Garachina.

The writings of Dampier and of Wafer are our earliest and still our best authorities on the topography of the adjacent country, and on the nautical circumstances of the coasts at those opposite points.—The following relevant passages occur in the works of Dampier.

"The gulf of St. Michael lies nearly thirty "leagues from Panama, towards the S.E. It "is a place where many great rivers having "finished their courses, are swallowed up in "the sea.—The chief rivers which run into "this Gulf of St. Michael, are, Santa Maria, "Sambo, and Congos.—Between the mouths "of the Congos and Sambo, on either side, the "gulf runs in towards the land somewhat nar-"rower, and makes five or six small islands, and "good channels between the islands; beyond "which, further in still, the shore on each side "closes so near with two points of low man-

" grove land, as to make a narrow, or strait,
" scarce half-a-mile wide. This serves as a
" mouth or entrance to the inner part of the
" gulf, which is a deep bay two or three leagues
" over every way; and about the east end there-
" of are the mouths of several rivers, the chief
" of which is that of Santa Maria; this is the
" way that the privateers have generally taken as
" the nearest between the North and South Seas.
" The river of Santa Maria is the largest of all
" the rivers of this gulf; it is navigable eight or
" nine leagues up, for so high the tide flows.
" Beyond that place the river is divided into
" many branches, and is only fit for canoes; the
" tide rises and falls in this river about eighteen*
" feet.

" All about these rivers, especially near the
" sea, the land is low; it is deep black earth,
" and the trees are extraordinary large and
" high."

Lionel Wafer observes, that " The Isthmus
" of Darien, in the narrowest part, is about one
" degree."—" On the North Sea coast the rivers
" are for the most part very small, for, rising
" generally from the main ridge which lies near

* Query, should it be *eight* or *ten* feet? as the tide does not rise higher at other parts of this coast; but see on the relative elevation of the two oceans.

" that shore, their course is very short; the " river of Darien is indeed a very large one, " but the depth at its entrance is not answerable " to the wideness of its mouth, though it is deep " enough further in."

Dampier elsewhere says, " we passed by the " river of Darien, which is very broad at the " mouth, but not above six foot of water " on a spring tide, for the tide riseth but little " here."

" The soil on this north coast," Wafer observes, " is various, generally it is good land " rising in hills, but to the sea there are here " and there swamps, yet seldom above half a " mile broad.

" Inclusively from Caret Bay, which lies in " the River* of Darien, and is the only harbour " in it, to the promontory near Golden Island, " the shore of the Isthmus is indifferently " fruitful, partly sandy bay, but part of it is " drowned, swampy mangrove land, where there " is no going ashore but up to the middle in " mud. The shore of this coast rises in hills " presently, and the main ridge is about five or " six miles distant. Caret Bay hath two or

* Dampier uses the term *river* instead of *gulf*, as Caret Bay is on the shore of the latter.

" three rivulets of fresh water falling into it as
" I am informed, for I have not been there.
" It is a little bay, and two small islands lying
" before it, make it an indifferent good harbour,
" and hath clear anchoring ground without any
" rocks.

" To the westward of the Cape, at the entrance
" of the river Darien is another fine sandy bay.
" In the cod of it lies a little low swampy
" island, about which it is shole water and dirty
" ground, not fit for shipping, and the shore of
" the Isthmus behind and about it, is swampy
" land overgrown with mangroves till after
" three or four miles the land ascends up to the
" main ridge, but though the cod of this bay
" be so bad, yet the entrance of it is deep
" water and hard sandy bottom, excellent for
" anchorage, and has three islands lying be-
" fore it, which make it an extraordinary
" good harbour. The eastermost of these
" three is Golden Island, a small one, with
" a fair and deep channel between it and the
" main.

" Having thus surveyed the north coast of
" the Isthmus, I shall take a light view of the
" south also. All the points of land from Cape
" Garachina to Cape St. Lorenzo are low
" drowned mangroves."

" The gulf of St. Michael is made by the " outlets of several rivers, the most noted of " which are the river of Santa Maria, and the " river of Congos though there are others of " a considerable bigness. Of these rivers to " the southward of Santa Maria, one is called " the Gold River; the next to the Gold " River is that of Santa Maria. It was along " this river we came when we first entered the " South Seas with Capt. Sharp, from the bay " by Golden Island where we landed. The " country all about here is woody, low, and " very unhealthy, the rivers being so oazy, that " the stinking mud infects the air, but the little " village of Scuchadero, near the mouth of it, " is seated on fast rising ground, admitting fresh " breezes from the sea, so that this is pretty " healthy. The river of Congos which falls " into the gulf, is made up of many rivulets " that fall from the neighbouring hills and join " into one stream. The mouth of it is muddy " and bare for a great way at low water, unless " just in the depth of the channel, and it affords " little entertainment for shipping; but further " in the river is deep enough, so that ships " coming in at high water, might find it a very " good harbour. The gulf itself hath several " islands in it, and up and down in and about " them there is, in many places, very good

" riding, for the most part in oazy ground. " The islands also, especially those towards " the mouth, make a good shelter, and the " gulf hath room enough for a multitude of " ships. The sides are everywhere surround- " ed with mangroves growing in wet swampy " land.

" From the gulf of St. Michael to the ridge of " hills lying off Caret Bay, it is a vale country, " well watered with the rivers that fall into that " gulf, but near the gulf it is very swampy and " broken, so that it is scarce possible to travel " along the shore thereabouts. Westward of " the river Congos the country grows more hilly " and dry, with pleasant and rich vales inter- " mixed till you are past the river Cheapo, and " thus far the whole country is all as it were " one continued wood, or rather a large forest " of timber trees very large and tall, with little " or no underwood; but on the sea-coast " where the soil is often swampy drowned land, " especially near the mouths of rivers, the trees " are not tall but shrubby, as mangroves, bram- " bles, bamboos, &c. in a continual thicket, so " close set, that it is a very difficult matter to " work one's way through these morasses.

" The season of rains begins in April or " May—about September the rains begin to " abate, but in November or December, and

" it may be part of January ere they are quite
" gone: so that 'tis a very wet country, and
" has rains for two-thirds, if not three-quarters
" of a year."

REMARKS ON THE TOPOGRAPHY OF THE ISTHMUS OF DARIEN.

It appears that there is a sufficiently good port for ships upon each coast of this Isthmus, the port upon the east coast being either Caret Bay, which lies in the gulf of Darien, or the anchorage within Golden Island, one of the islands of the sandy bay to the westward of the Cape, at the entrance of the gulf of Darien. The port on the west coast is some one of the spacious and secure anchorages within the gulf of St Michael. It appears that this gulf, the bay within it, and probably a considerable portion of the navigable part of the river Santa Maria, form a natural navigation for ships across nearly one-third part of the Isthmus, the breadth of which, in the narrowest part, Lionel Wafer states, is about one degree or sixty miles. It appears, however, that above the place to which the tide flows, the river Santa Maria is divided into many branches, and is only fit for canoes, hence it is evident, that to complete a ship canal at this place, the works of excavation would extend at least forty miles in length, gradually increasing in depth of excavation as the land ascends, until the main ridge of the mountain itself is

encountered. For though Wafer observes, that "from the gulf of St. Michael to the ridge of "hills lying off Caret Bay, it is a vale country, "well watered with rivers that fall into that "gulf," yet it appears from the smallness of those rivers until they form by combination the river Santa Maria, that there is a considerable difference of level or descent in the grounds through which they flow, and that those rivers would not furnish a supply of water at all adequate for the summit level of a ship canal, raised by locks above the level of that part of the river Santa Maria, which is suitable for sea-going ships. It would therefore be necessary to commence the work of deep excavation at the navigable part of that river to which the tide flows, and to cut down the whole line of canal, to the enormous depth that would be requisite to fill the canal and its reservoirs with sea water, either from the North Sea, or from the tide water of the South Sea, whichever shall be found to rise highest. When it is considered that in this operation, is included the stupendous performance of cutting down to the same level, the main ridge of the mountain itself, which, exclusive of smaller hills, lies about five or six miles distant from the eastern shore, the project might perhaps deserve the character of extravagance, and almost of absurdity, according

to ordinary calculations and conceptions; but the importance and value of the design would be a justification and reward, for any effort that could be made for its accomplishment. A precedent may be adduced of an hydraulic achievement of at least comparative magnitude; there being the instance of the Desague Real de Huehuetoca, a drain or immense cut, which, during the last two centuries, has been carried through the Cordilleras that surround the valley of Tenochtillan or Mexico, at Nochistongo—to cut off the chief source of the dreadful inundations which almost periodically afflict the city of Mexico. "The *Desague*," Humboldt says, "in its actual "state, is undoubtedly one of the most gigantic "hydraulical operations ever executed by man. "We look upon it with a species of admiration, "particularly when we consider the nature of "the ground, and the enormous breadth, depth, "and length of the aperture. If this cut were "filled with water, to the depth of ten metres, "(32,8 feet) the largest vessels of war could "pass through the range of mountains which "bound the plain of Mexico to the north-east. "However we regret that so much collective "strength was not employed in some greater "and more useful object, in opening, for example, "not a canal but a passage through some isth-"mus which impedes navigation." Humboldt

adds, " these trenches are only advantageous " when the hills are of small elevation and small " breadth, and when they contain strata, less " subject to falling down. The section (of the " Desague of Huehuetoca) for a considerable " distance is from 1,800 to 3,000 square metres " (from 19,365 to 32,275 square feet), and ac- " cording to the measurement of M. Velasquez, " its length from Vertidores to the Salto 20,585 " metres (67,535 feet), equal to 4¾ common " leagues; at the point where the ridge is " highest, near the old well of Don Juan Gar- " cia, for more than a length of 800 metres " (2,624 feet), the cut in the mountains is from " 45 to 60 metres (from 147 to 196 feet), in " perpendicular depth; from the one side to the " other, the breadth at top is from 85 to 110 " metres (from 278 to 360 feet); the depth of " the cut is from 30 to 50 metres (from 98 to " 131 feet), for a length of more than 3,000 " metres (11,482 feet); but in a great part " of the cut, its breadth is by no means in " proportion to its depth, so that the sides, " in place of having a slope of 40° or 50°, " are much too rapid, and are perpetually " falling in.

" It appears from a manuscript memoir of " Don Ignacio Castero, inspector (*maistro ma-* " *jor*) of hydraulical operations in the valley

" of Mexico, that the Desague cost, including " the repairs of the dikes *(albaradones)*, be- " tween 1607 and 1789, the sum of 5,547,670 " double piastres. If we add to this enormous " sum from 6 to 700,000 piastres, expended in " the fifteen following years, we shall find that " the whole of these operations (the cut through " the mountains of Nochistongo, the dikes, and " the two canals from the upper lakes) have " not cost less than thirty-one millions of livres, " £1,291,770," but M. de Humboldt had previously told us that, " twenty-five millions of " livres were expended, because they never had " courage to follow the same plan, and because " they kept hesitating for two centuries, be- " tween the Indian system of dikes, and that " of canals, between the subterraneous gallery " (Socabon), and the open cut through the " mountain (tajo abierto), and the cut (tajo) " of Nochistongo, was neglected to be finished, " while they were disputing about the project " of a canal of Tezaico, which was never " executed." Hence it is doubtful whether De Humboldt means that twenty-five millions of the thirty-one millions of livres which those works cost, were uselessly and unnecessarily expended. If that is his meaning, the necessary cost of the works was, but six millions of livres (£250,000), and from that

sum, we are expressly enabled by him to deduct a further sum of one million of livres (£41,670), the cost of the two canals of Zumpango and San Christobal, begun in 1796 and 1798, as these distinct and subsequent works are comprised in the account of thirty-one millions of livres. The net cost of the Desague, appears, therefore, to have been five millions of livres (£208,340), including the cost of certain dikes, which De Humboldt does not separately specify, and which we therefore cannot deduct from the remaining five millions, as should be done with a view to the purposes of this work, because these dikes are not part of the trench, called the Desague, though they might have been necessary to its operating as a drain on the waters of part of the valley of Mexico. But although these deductions might be warranted by that author's words, the comparative smallness of the sum of £208,340, seems to be out of proportion, and not reconcileable to the magnitude of the Desague.

In applying this important quotation from the writings of De Humboldt, to the subject of intersecting the Isthmus of Darien by a similar Desague or trench, but, for the purpose of ship navigation, it should be observed that the height of the lowest part of the main ridge of the mountains which lie between the river Santa

Maria, and Caret Bay, or the port at Golden Island, near the mouth of the river Darien, has not yet been ascertained. We only know from Lionel Wafer's writings, that the ridge of mountains, is, in that part, lower than the main ridge at those places at which he and Dampier crossed the mountains, in their journeys back from the Bay of Panama to the mouth of the river Conception, opposite to La Sound's key, one of the Samballoe islands.

If on survey it should be found practicable, and if it should ever be deemed expedient to cut a ship channel across the ridge of the mountains at Darien, the above described defects in the banks of the river Santa Maria, might be remedied by raising them with the earth that would be excavated in making the channel, as the modern facilities of railways and locomotive engines, would render the removal and dispersion of that superflous soil, however vast in quantity, a comparatively easy operation.

The consideration of the impediments to the execution of such a work, which would arise from the climate and diseases of the Isthmus of Darien, will be comprised in a general section on the climate and diseases of the whole American Isthmus. There is modern authority on the general subject, which makes this distribution of it advisable, as changes appear to have oc-

curred in the climate and diseases of some parts of the American Isthmus, since the time of Dampier and Wafer, and it is probable that further changes might occur in consequence of the opening of a ship navigation from sea to sea.

TOPOGRAPHY OF THE ISTHMUS OF PANAMA.

This portion of the greater Isthmus of America, (as generally understood,) lies between the town of Panama, and the navigable part of the river Chagre which enters the North Sea.

Dampier and Wafer have many striking observations, which are applicable to the Isthmus of Panama. Their journeys commenced at a creek which is about four miles from Cape St. Lorenzo, situated in the bay of Panama, and were performed for the most part, in a north-east and northerly direction to the river Conception, which runs into the North Sea, opposite to La Sound's key, one of the Samballoe islands; and therefore their topographical remarks do not specifically relate to the Isthmus of Panama as above defined. But as Wafer says, that, "what he has had occasion to say, is in "some measure applicable to the country, even "beyond Panama," it is under that necessary limitation that the following abstracts have been made from their authentic writings.

Dampier says, "New Panama is encom-"passed on the backside, with a pleasant coun-"try, which is full of small hills and valleys, "beautified with many groves and spots of

" trees. Panama enjoys a good air, lying open
" to the sea wind. There are no woods nor
" marshes near Panama, but a brave dry cham-
" pion land, not subject to fogs nor mists."

" The river Cheapo springs out of the moun-
" tains on the north side of the country, bends
" its course to the westward, and being swelled
" to a considerable bigness, it runs with a slow
" motion into the sea, seven leagues from Pa-
" nama. This river is very deep, and about a
" quarter of a mile broad; but the mouth of it
" is choked up with sands, so that no ships can
" enter, but barks may."—And again he says,
" Cheapo is a considerable river, but has no
" good entering into it for sholes; its course is
" long, rising near the North Sea, and pretty
" far from towards the east. About this river
" the country something changes its face, being
" savanna on the west side: though the east
" side is wood-land.

" This side of the bay of Panama, runs out
" westerly to the islands of Quito; there are on
" this coast several rivers and creeks, but none
" so large as those on the south side of the bay.
" It is a coast that is partly mountainous,
" partly low land, and very thick of woods bor-
" dering on the sea, but a few leagues within
" land it consists mostly of savannas.

" These savannas are not level, but consist

" of small hills and valleys with fine spots of " woods intermixed, and from some of these " hills not far from Cheapo, the river of Chagre, " which runs into the North Sea, takes its rise; " it runs west for a while, and on the south side " of it, at no great distance from Panama, is " Venta de Cruzes, a small village of inns and " store-houses, whither merchandises that are to " be sent down the river of Chagre, are carried " from Panama by mules; the country here also " is savanna and wood-land, intermixed with " thick short hills, especially towards Panama."

Lionel Wafer's general observations, which he considers "in some measure applicable to " the country even beyond Panama," are to the following effect:—

" The land is almost everywhere of an un- " equal surface, distinguished with hills and " valleys of great variety for height, depth, and " extent; the valleys are generally watered " with rivers, brooks, and perennial springs, " with which the country very much abounds; " they fall, some into the North Sea, and some " into the South, and do most of them take " their rise from a ridge or chain of higher hills " than the rest, running the length of the Isth- " mus, and in a manner parallel to the shore, " which for distinction sake, I shall call the " main ridge.

" This ridge is of an unequal height, and " trends along, bending as the Isthmus itself " doth ; it is in most parts nearest the edge of " the North Sea, seldom above ten or fifteen " miles distant ; nor is the main ridge itself " carried on everywhere with a continued top, " but is rather a row or chain of distinct hills, " than one prolonged, and accordingly hath fre- " quent and large valleys, disjoining the several " eminences that compose its length ; some of " these valleys are so deep in their descent, as " even to admit a passage for rivers ; for thus " the river Chagre, which rises from some hills " near the South Sea, runs along in an oblique " north-westerly course, till it finds itself a pas- " sage into the North Sea, though the chain " of hills, if I mistake not, is extended much " further to the west, even to the lake of Ni- " caragua."

Wafer further says, "the rivers that water this " country, are some of them indifferent large, " though but few navigable, as having bars and " sholes at their mouths. On the North Sea " coast, the rivers are for the most part very " small, for rising generally from the main ridge, " which lies near that shore, their course is very " short ; from thence (the river Darien) to " Chagre, the whole length of this coast, they " are little better than brooks, nor is the river

" of Conception any other which comes out over
" against La Sound's Key, in the Samballoes.
" The River of Chagre is pretty considerable,
" for it has a long bending course, rising as it
" does from the south and east parts of the Isth-
" mus, and at such a distance from its outlet,
" but in general the north coast is plentifully
" watered, yet it is chiefly with springs and
" rivulets, trickling down from the neighbour-
" ing hills.

" The soil on this north coast is various;
" generally it is good land rising in hills, but
" to the sea there are here and there swamps,
" yet seldom above half a mile broad. The
" country beyond this (Portobello), westward
" to the mouth of the Chagre, is partly hilly,
" and near the sea very much swampy; and I
" have heard by several, that there is no com-
" munication between Portobello and the mouth
" of that river." On the southern shore, at and near Panama, Wafer has the following apposite, though detached remarks: "between the River
" of Cheapo and Panama, are three rivers of no
" great consequence; the land between is low
" even land, most of it dry, and covered here and
" there with short bushes; near the most west-
" erly of these, old Panama was seated, the
" river runs rather nearer the new town than
" the old, and into this river small barks may

" enter. The chief advantage which new Pa-
" nama has above the old, is an excellent *road*
" for small ships, for which it is beholden to the
" shelter of the neighbouring isles of Perica,
" which lie before it three in number, in a row
" parallel to the shore; there is very good an-
" choring between, at a good distance from the
" town, but between the road and the town is a
" shoal or spit of land, so that ships cannot
" come near the town, but lie nearest to Perica:
" the town is surrounded with savannas, gentle
" flat hills, and copses of wood. The place is
" very sickly, though it lies in a country good
" enough, but possibly it is only so to those who
" come hither from the dry pure air of Lima
" and Truxillo, and other parts of Peru, who
" grow indisposed presently, yet it is very
" healthy in comparison of Portobello.

" About a league to the west of Panama, is
" another river which is pretty large, and is
" called by some, Rio Grande; it is shoal at
" the entrance, and runs very swift, and so is
" not fit for shipping."

To the foregoing descriptions, William Funnel who sailed under the command of Captain Dampier adds, " the port of Perica is the har-
" bour for Panama, but distant from it three
" miles, for the great ebbing and shoalness of
" the water; will not suffer any great ship to

" come any nearer than the Island of Perica, " yet small vessels run through a little creek " close up to the city."

From the able and interesting narrative of the voyage of the De Ulloas, we extract the following account of the ascent to the river Chagre, and of their journey from Cruces to Panama. " The " next day (23d December 1735), we began to " row up the river; on the 24th we endeavoured " to proceed in the same manner, but the force " of our oars being too weak to stem the cur- " rent, we were obliged to set the vessels along " with poles, we measured the velocity of the " current, and found it ten toises and one foot " in forty seconds and a half. In this slow and " toilsome manner, we proceeded till the 27th, " at eleven in the morning, when we arrived at " Cruces, the landing place about five leagues " from Panama. As we advanced up the river, " we found a great increase in the velocity of " the current, which on the 25th was ten toises " in twenty-six seconds and a half; on the 26th, " at the place where we anchored for that night, " ten toises in fourteen seconds and a half, and " on the 27th, at the town of Cruces, the same " space in sixteen seconds; consequently the " greatest velocity of the water is 283 toises, or " about a league (Spanish) in an hour.

" Its banks are impassable both on account of

" the closeness of the trees, and the bushes which
" cover the ground as it were with thorns, many
" of them being undermined by the water, are
" thrown down by the swellings of the river,
" they remain near their original situation to
" the great danger of the vessels, for a vessel
" by striking suddenly on them is frequently
" overset. Another obstruction to the navi-
" gation of this river is the races or swift cur-
" rents over the shallows, where those vessels,
" though built for that purpose, cannot pro-
" ceed for want of a sufficient quantity of
" water, so that they are obliged to be light-
" ened, till they have passed the shallow.

" The barks employed on this river are chatas
" and bongos, called in Peru, bouques; the
" first carry six or seven hundred quintals, the
" bongos four or five hundred.

M. De Humboldt says, that " to form an
" idea of the uncertainty which still prevails as
" to the form and breadth of the Isthmus, (Pa-
" nama), for example, towards Nata we have
" only to compare the maps of Lopez with
" those of Arrowsmith, and with the more
" recent ones of the Deposito Hydrographico of
" Madrid. The barometrical heights related
" in the travels of Ulloa, lead me to suppose that
" there exists in the Rio Chagre, from the sea
" of the Antilles to the Embarcadero or Venta

de Cruces, a difference of level of from 35 to
" 40 toises. The engineers in proposing to the
" Court of Madrid, that the river Chagre should
" serve for a communication between the two
" oceans, have projected a canal from the Venta
" de Cruces to Panama. This canal would
" have to pass through a hilly tract, of the
" height of which we are completely ignorant;
" we only know that from Cruces the ascent is
" at first rapid, and that there is then a descent
" for several hours towards the South Sea. It
" appears beyond a doubt that we find the
" principal cordillera, or rather a prolongation
" of the Andes towards the South Sea, between
" Cruces and Panama; however, Lionel Wafer
" assures us, that the hills which form the cen-
" tral chain, are separated from one another by
" valleys which allow free course for passage
" of the rivers; if this last assertion be founded,
" we might believe in the possibility of a canal
" from Cruces to Panama, of which the naviga-
" tion would only be interrupted by a very few
" locks."—" These sinuosities, however, afford
" a counter-current by means of which small
" vessels ascend the river in aid of other means.

" There are other points, where according to
" memoirs drawn up in 1528, the Isthmus has
" been proposed to be cut, for example, in
" joining the sources of the rivers Caimito and

" Rio Grande, with the Rio Trinidad. The " eastern part of the Isthmus is the narrowest, " but the ground appears to be also most ele- " vated there; this is at least what has been " remarked in the frightful road travelled by " the courier from Portobello to Panama, a " two day's journey, which goes by the village " of Pequerri, and is full of the greatest diffi- " culties.

" What is the height of the mountains where " the Isthmus is narrowest? what is the breadth " of the Isthmus, at the point where the chain " of mountains is least elevated? these are the " two great questions which an enlightened go- " vernment should endeavour to resolve, by " employing an experienced observer. No " measure of elevation, and no level has ever " yet been executed in the Isthmus of Panama.

" From all the information which I could " procure, relating to this Isthmus, while I " remained at Carthagena and Guayaquil, it " appears to me that the expectation of a canal " of seven metres in depth, and from twenty- " two to twenty-eight metres in breadth, which " like a pass or strait, should go from sea to " sea, and admit the vessels which sail from " Europe to the East-Indies, ought to be com- " pletely abandoned. The elevation of the " ground would force the engineer to have

" recourse either to subterraneous galleries, or " to the system of sluices, and the merchandizes " destined to pass the Isthmus of Panama, " could only therefore be transported in flat- " bottomed boats, unable to keep the sea. " *Entrepôts* at Panama and Portobello would " be requisite, every nation which wished to " trade in this way, would be dependent on " the masters of the Isthmus and canal; sup- " posing then that this canal were cut, the " greatest number of these vessels would pro- " bably continue their voyage round Cape " Horn. We see that the passage of the sound " is still frequented, notwithstanding the exis- " tence of the Eyder canal, which connects the " ocean with the Baltic Sea.

" In the present state of things, the carriage " of three-quintals on muleback from Panama " to Portobello costs from three to four pias- " tres.* The whale and cachalot fishery which " in 1803, drew sixty English vessels to the " South Sea, and the facilities for the Chinese " commerce, and the furs of Nootka are baits " of a very seductive nature, they will draw " sooner or later, the masters of the ocean to a " point of the globe, destined by nature to " change the face of the commercial system of " nations.

* From 12*s.* 6*d.* to 16*s.* 8*d.*

Next in the order of time, to the elaborate work of M. De Humboldt, appeared the Edinburgh Review, for January 1809; Art. II. contains the following passages, at page 282. "In enumerating, however, the advantages of "a commercial nature which would assuredly "spring from the emancipation of South Ame- "rica, we have not yet noticed the greatest, "perhaps, of all—we mean the formation of a "navigable passage across the Isthmus of Pa- "nama, the junction of the Atlantic and Pacific "Oceans. It is remarkable that this magnificent "undertaking, pregnant with consequences so "important to mankind, and about which so "little is known in this country, is so far from "being a romantic and chimerical project, that "it is not only practicable but easy. The river "Chagre, which falls into the Atlantic at the "town of the same name, about eighteen "leagues to the westward of Portobello, is "navigable as far as Cruces, within five leagues "of Panama; but though the formation of a "canal from this place to Panama, facilitated "by the valley through which the present road "passes, appears to present no very formidable "obstacles, there is still a better expedient. "At the distance of about five leagues from "the mouth of the Chagre, it receives the river

" Trinidad, which is navigable to Embarca-
" dero; and from that place to Panama is a
" distance of about thirty miles, through a level
" country, with a fine river* to supply water for
" the canal, and no difficulty whatever to coun-
" teract the noble undertaking. The ground
" has been surveyed, and not the practicability
" only, but the facility of the work completely
" ascertained. In the next place, the important
" requisite of safe harbours, at the two extre-
" mities of the canal, is here supplied to the
" extent of our utmost wishes. At the mouth of
" the Chagre is a fine bay, which received
" the British 74 gun ships in 1740, and at the
" other extremity is the famous harbour of
" Panama.†"

Then followed the letter addressed by Mr. Walton to the editor of the Colonial Journal, which appears in that work for March 1817, under the title of " The Isthmus of Panama, " considered as affording a Passage to unite the

* Probably the river Caimito.

† For the accuracy of the statement, the Edinburgh Review refers to a work published in 1762, by Thomas Jefferys, geographer to his Majesty, entitled, " A Description of the Spanish " Islands and Settlements on the Coasts of the West-Indies; " compiled from authentic Memoirs, revised by Gentlemen who " have resided many years in the Spanish Settlements, and il- " lustrated with thirty-two Maps and Plans, chiefly from original " Drawings taken from the Spaniards in the late War."

"Pacific with the Atlantic or Western Ocean." After a quotation of the foregoing passage from the Edinburgh Review, Mr. Walton styles the project "a delusive speculation," and asserts that, "as a means to shorten the passage to "Asia or the north-west coast of America, the "two main objects in view, the configuration "of the spot, and other physical circumstances, "render the success of the undertaking utterly "impossible." The writer then presents those ideas which he had collected upon the subject, "during a recent stay of thirty-five days in the "city of Panama, fourteen at Cruces, and eight "at Chagre, for the purpose of conveying over "produce;" in which operation, many of the difficulties which he therein specifies were practically experienced; and adds, "to the "south, the town (Panama) is surrounded and "defended by a range of small islands, and the "anchoring place for vessels lies to the east of "one of them; and the distance from the town, "which in reality exceeds seven miles, deprives "Panama of the consideration of a port, since "the harbour can be viewed in no other light "than as a roadstead. Here, then, is the first "difficulty; even if the Isthmus were cut across, "it would be necessary to open a passage of "several miles into the sea, since, in the present

" situation of the bay, no other than flat-bot-
" tomed boats can approach the shore.

" The want of application to agricultural
" pursuits, is certainly one of the causes of
" the great unhealthiness of the climate; the
" air, in passing through the rank and wet
" foliage, acquires a dampness that is pesti-
" lential; the uncovering lands of this nature
" is by no means one of the smallest obstacles
" to be overcome, before the attempt to open
" a canal is made; it would fill the air with
" such an abundance of deadly particles, that
" for a considerable time the country would
" be scarcely tenable for whites.

" The temperature of the climate on the
" Isthmus is humid and hot, and therefore
" unhealthy and destructive to Europeans.
" Persons who have withstood every other
" climate of the great continent, there become
" languid; and though the negroes appear fat
" and hearty, and are possessed of personal
" strength to bear the heaviest burdens, yet
" want alone impels them to work.

" Cruces is usually rated at seven leagues'
" distance from Panama, but the direct route
" over the mountains from La Venta de Cruces
" to Panama, may be safely estimated at
" twenty-five miles. At Cruces the treasures

" and produce conveyed from Panama, and
" intended to be shipped across the Atlantic,
" are put into large canoes, and also into
" bonjos or flats, which carry equal to two
" hundred quintals; but in descending the
" river in the dry season, they are frequently
" obliged to unload the boats, owing to the
" shallows being so great, which makes even
" the passage down extremely tedious and
" uncertain: an empty canoe can arrive at
" Chagre in two days, whilst a loaded one
" frequently requires more than triple the
" length of time to perform the voyage.

" The chatas or bonjos (flats) are navigated
" by fourteen or sixteen negroes, who, in as-
" cending the rivers, generally row one third
" of the distance; but the current then be-
" comes so rapid, that they are obliged to
" pole the remaining part of the way, which
" often takes them twelve, and even twenty
" days.

" The river Chagre, or Cruces, which names
" it indiscriminately bears, takes its source in
" the mountains of Chiman, and meanders
" a distance of eighteen or twenty leagues
" over unequal ground, but is only navigable
" below Cruces; there it is about 150 yards
" wide: but the bed of the river is never com-
" pletely filled, unless in the rainy seasons,

" which occur in May and September, when the
" rapids are very great, and, notwithstanding
" the dexterity of the boatmen, it is impossi-
" ble to ascend till the waters partly sub-
" side. The course of this river is extremely
" sinuous. The distance by the windings of
" the river is rated by the people of the coun-
" try at eighteen leagues, but it is about fifty-
" two miles. The stream falls into the sea of
" the Antilles, to the westward of Portobello,
" which is about nine Spanish leagues dis-
" tant."

" The breadth of the river Chagre at the
" entrance is 120 toises, or 240 yards; and the
" depth of water on the bar is only ten feet:
" so that the two extremities of this projected
" point of communication may be considered
" without a port; for the Chagre only admits
" small schooners; and to Panama, as we
" have already noticed, large vessels cannot
" approach nearer than the island of Perico."

" The first consideration is, whether the
" river Chagre is to serve for part of the in-
" tended communication between the Atlantic
" and the South Sea, or whether a new canal
" must be opened. The ambition of the Spa-
" nish projectors never carried them beyond
" the hopes of opening a canal from the em-
" barcadero of Cruces to Panama; of conse-

" quence, they were of opinion that the small " advantages which the river affords were to " be made use of.

" Humboldt deduces from the barometrical " heights mentioned in Ulloa's travels, that " there only exists between Cruces and the bed " of the sea at the mouth of the Chagre, a dif- " ference of forty toises, or eighty yards; which " must, indeed, appear underrated, when it is " reflected that a very small part of the velo- " city of the current is occasioned by the ac- " cumulation of water above Cruces, but must " be in a great measure owing to the inclined " bed of the river: were it then estimated at " twice that amount, which it certainly will " admit, it would be easy to calculate how " many sluices or locks would be necessary in " the distance from Chagres to Cruces, to " admit a vessel of twenty-two or twenty-three " feet, which is almost the smallest water " drawn by any ship sailing to Asia: but when " even arrived at the above point, the diffi- " culty would not be more than one-third " overcome.

" A chain of mountains, or Cordilleras, which " Humboldt regards as a prolongation of the " Andes of New Grenada, runs along the Isth- " mus, bending as it inclines, and flanked by " other lofty hills rising on both sides; these

" intermediate mountains, owing to their " obstructive elevation, prevent the possibi- " lity of seeing the two seas from a central " part of the Isthmus, as the hills extend to " within two leagues of the shores of the " South Sea, at which distance the latter can " alone be discerned."

" The road from Cruces to Panama does not " so much extend over the heights as it winds " round their sides; for a distance of about " four leagues it rises and declines, crossing " in that space three small valleys, which " have rivulets running through them; but " it would be very difficult for an engineer to " bring them to any perfect level, from the " necessity of arches in some places, and sub- " terraneous passages in others. The highest " of these mountains is of about an equal " height with the second order of the Alps; " but the road winds across a very small part " of its central base.

" Even were the same locality more favour- " able than it is, no hydraulic plan could be " carried into effect till a new colony of Euro- " peans had been sent thither to give impulse " and activity to the present inhabitants, or " negro slaves expressly procured, which, in " the present order of things, is impractica- " ble. The most that could be procured in

" the country, at present, would be about five " hundred labourers, many of whom would not " be worth employing; but even were it effect- " ed partially, as the bounds of nature would " alone admit, Panama could only become an " *entrepôt* for merchandize. But, besides the " local obstacles of the country, to overcome " the abject state of the natives appears " amongst the great impediments, and to " leave no hopes whatever that, even on a " partial scale, the thing will be attempted: " disease will always be a barrier against " settling upon it (the Isthmus of Panama), " with a view to improve its geographical " situation.

" In the present state of things, therefore, " of what great moment is the tenure of the " Isthmus of Panama alone, since the nation " that is in possession of Peru and Chili can " at all times distress it in the extreme, by cut- " ting off supplies of provisions, or by haras- " sing parties? Nor is it to be forgotten, that " to ascend from Panama to Lima, in conse- " quence of the currents and calms, a vessel " often requires more time than to cross the " whole Atlantic. The additional expense of " land conveyance was never less than thirty " per cent., which was accumulated on the " returns."

Again, in the Colonial Journal for June 1817, Mr. Walton observes, "it is nearly seventy "years since the Isthmus ceased to be the "channel through which the treasures of Peru "and Chili passed on their way to Europe. "Few schemes of general importance could "be more desirable than that of drawing Asia "nearer to Europe; yet that the Isthmus of "Panama will at any time become the point "of that approximation, appears beyond the "hopes of the most sanguine; not only be- "cause of its difficult locality and bad climate, "but also of the shoals which surround its "shores, and leave it no other port than Porto- "bello to the north."

"The whole of the gulf (of Panama) is "covered with shoals and flats; in no part "of its shores could a dock or building-yard "be established, owing to the impossibility of "launching even a vessel of twenty tons; all "the circumjacent shores, for the distance of "seven miles from the town, have only a "fathom and a half of water, which lessens "gradually, so as only to admit into the har- "bour the boats and canoes used in the "country."

The next publication which, in order of time, appeared on this question, consisted in "Obser- "vations on the Practicability of Opening a

"Commerce between the Pacific and Atlantic
"Oceans," which are annexed to the Memoirs of the Mexican Revolution, by William Davis Robinson, Esq., who, in combating the assertions above quoted from the Edinburgh Review, says: "But even admitting that "human ingenuity and labour should surmount the physical obstacles, and that a "canal should be completed from Cruces to "Panama, we nevertheless encounter at the "latter an impediment that we firmly believe "to be insuperable: the extreme shallowness "of the water near the beach, not only in the "bay, but along the whole coast, opposite to "those places where the projectors of the canal "have contemplated cutting a passage; in "fact, the bay of Panama is nothing more than "an open roadstead. A channel there would "be liable to the operation of the same causes "that have thrown up the sand along the shore "of the bay, and would be perpetually filling "up. But, even admitting that all these impediments could be overcome, and that a "passage should be opened sufficient to allow "vessels, drawing eighteen or twenty feet of "water, to proceed as far as Cruces, they "would not then find a sufficiency of water to "descend the Chagre, and to pass the bar at "its mouth; it would be necessary therefore to

" continue the canal by another route, through " the entire Isthmus, before it could be used " as a passage for the navigation of large ves- " sels. The only difficulty, in our estimation, " is, to find out a practicable route for a canal " capable of admitting large vessels to pass " from one ocean to another."

Lastly, there is the following slight notice of this route in the elegant and interesting work of Captain Basil Hall, R.N., entitled "Ex- " tracts from a Journal, written on the Coasts " of Chili, Peru, and Mexico," &c., who, in speaking of one of the merchants of Pa- nama, says, "He was a very intelligent per- " son, who had studied particularly the ques- " tion of cutting a passage across the Isthmus, " and had actually examined several of the " proposed lines. He seemed to consider the " passage at the narrowest point, which on the " map looks so tempting, as by no means the " best; but I had no opportunity of gaining any " new information on the subject."

REMARKS ON THE TOPOGRAPHY OF THE ISTHMUS OF PANAMA.

THREE routes, or means for effecting a navigable communication between the two seas, appear to be offered by the Isthmus of Panama. One of them would make use of the navigable part of the river Chagre, and connect it with the harbour or roadstead of Panama, by a canal from the Venta de Cruzes. Another would require the aid of the river Trinidad which joins the river Chagre five leagues from its entrance, and is navigable to Embarcadero; and from that place to Panama, a distance of about thirty miles, a canal might be formed through a level country, there being, it is alleged, a fine river that would provide an ample supply of water for the purpose. The third route must be such as may be found amongst the lowest and best connected valleys entirely across the Isthmus, for a canal adequate to sea-going ships, which would not make use of the channels of any of those rivers, but would be supplied with water for its summit and higher levels from all their streams.

Now each of these routes must make use of the roadstead of Panama, aided by an artificial harbour, on the one side, and of Chagre or Portobello

on the other, for the purpose of terminating each end of the proposed ship-canal.* It is easy to reconcile the apparent contradiction between the fact stated by Mr. Walton, that "the depth of "water on the bar of the river Chagre is only "ten feet, and only admits small schooners," and the fact quoted by the Edinburgh Review, from the work of Thomas Jeffreys, that "at the "mouth of the Chagre is a fine bay, which re-"ceived the British 74-gun ships in 1740," by observing that the bar of the river is, as usual, within the bay, and that the latter authority cannot imply that the British 74-gun ships crossed the bar of the river Chagre; the bay, if there is one, being situated like other bays, outside of the bar of its river.

In respect of the total unfitness of Panama for a port of entry or exit, there is the uncontradicted testimony of Mr. Walton, that "all "the circumjacent shores, for the distance of "seven miles from the town, have only a fa-"thom and a half of water" (it is presumed he means at full tide), "so as only to admit "into the harbour the boats and canoes used "in the country." The probability that Mr. Walton means at full tide, is sustained by the assertion of M. De Humboldt, that "the tide,

* Dampier and Wafer show, that there are not any other places accessible to navigation on either coast of the Isthmus of Panama.

" when it falls, leaves exposed, for a great way
" into the bay, a large extent of ground
" covered with *fucus ulvæ et meducæ.*" And obviously consistent with these authorities are the general observations of Wafer, namely, " that the chief advantage which new Panama
" has above the old, is an excellent road for
" small ships, for which it is beholden to the
" neighbouring isles of Perica. There is very
" good anchoring between the islands and the
" shore, at a good distance from the town; but
" between the road and the town is a shoal or
" spit of land, so that ships cannot come near
" the town, but lie nearest to Perica." The assertion of Funnel (who accompanied Dampier), that " the port of Perica is the harbour
" for Panama," is also reconcileable with the same authorities, as he explains the terms of port and harbour by adding, " but distant
" from it three miles." Walton says " seven
" miles," counting probably the distance by the gully or creek, through which barks or boats pass the shoal or spit of land; and he appears to be correct, as Funnel adds, " for the great ebbing
" and shoalness of the water, will not suffer
" any great ship to come any nearer than the
" island of Perica, yet small vessels run through
" a little creek close up to the city." On the principle of this explanation, we also find the

observation of Captain Hall, upon Panama, consistent with the preceding authorities.

"We anchored in Panama roads, and as no one "on board was acquainted with the place, a "fisherman was called alongside, who under- "took to pilot our boat through the reefs to "the landing place. On rowing round the angle "of the fortifications encircling the town, "which is built on a rocky peninsula, we found "ourselves in a beautiful little bay."

It is however to be understood, that a mere anchorage or roadstead may be a sufficiently good port or harbour, for ships destined for sea warfare, because it may answer sufficiently well for their purpose as a place of mere shelter during a temporary stay, though the same anchorage or roadstead is very far from deserving the name of port or harbour for commercial shipping, which have to carry and deliver their cargoes within the precincts of the shore. It may be as well to observe that Captain Hall entered the bay of Panama in his boat, and apparently, from the facts he states, at the time of high tide.

The unfitness and incapability of the opposite ports on each coast of this isthmus for the reception of sea-going ships being thus evident, it is scarcely necessary to add a word upon that part of the subject; But that we may present

to the reader, every point of this branch of the subject, it is only requisite to quote the authority of Dampier and of Wafer, to show that the rivers of any magnitude worth notice which lie nearest to Panama, on either side, namely, the river Cheapo on the east and the Rio Grande on the west of that town, do not contain harbours, and are totally incapable of being improved to that extent.

Dampier says, "The river Cheapo being "swelled to a considerable bigness, runs with "a slow motion into the sea, seven leagues "from Panama. This river is very deep, and "about a quarter of a mile broad, but the "mouth of it is choked up with sands, so that "no ships can enter, but barks may;" and afterwards he says, "Cheapo is a considerable "river, but has no good entering into it for "sholes."

"This side of the bay of Panama runs but "westerly to the islands of Quibo; there are "on this coast several rivers and creeks, but "none so large as those on the south side of "the bay."

Wafer says, "About a league to the west "of Panama, is another river, which is pretty "large, and is called by some Rio Grande; it "is shole at the entrance, and runs very swift, "and so is not fit for shipping."

No authentic or exact description of the mouth of the river Caimito, for the purpose of navigation, has been published; but there can be little doubt that it deserves the general character above given, by Dampier and Wafer, of the rivers on the west side of the bay of Panama.

Such being the incurable defects of the existing ports of this Isthmus, and the impossibility of substituting others, unless Portobello to the north can be annexed to the plan by a ship canal, it seems almost superfluous to discuss the merits of the river navigations which exist within the Isthmus. River navigation, except under peculiarly favoured circumstances, is too uncertain in the volume of its stream, and in the rate of its current, to be employed, or to be depended on if it could be employed, for the passage of ships. It is manifest, from the foregoing authorities, that the river Chagre is rendered utterly inadequate and unfit for that purpose, by its rapids, its shallows, its frequent mountain floods, its too great descent of 40 toises (Walton estimates it at 80 toises) in a course of fifty-two miles, the consequent celerity of its current in ordinary states of the weather, and its insufficient depth or volume for ship navigation, and from being devoid of the aid of tides, which are scarcely perceptible on the north coast of that Isthmus.

It is presumable from the nature of the country, that the rivers Trinidad and Caimito, of which we have not as yet any topographical descriptions, are subject to the same or similar impediments and defects. We are, therefore, warranted in considering this head of the subject as narrowed down to the mere possibility that a continuous line of levels suitable for a ship-canal may be found in the valleys of this Isthmus, and in such positions that the above-mentioned rivers would at all times furnish an ample supply of water to the summit or higher levels of such a ship-canal.

In ordinary cases, where the rivers are navigable, though by canoes only, there are generally lines of levels suitable for canals; and we can compute the magnitude of the supplies of water that may be commanded for the use of such a canal. But, in the case before us, it does not appear that any river flowing to the South Sea offers a facility for navigation, beyond that of a supply of water.

In this ignorance of the surface of the country, of its elevations, its levels, and their connections, we can only recur to the authentic descriptions given of the face of the country, between the river Chagre and Panama, by Dampier, Wafer, De Ulloa, and Walton.

Dampier says, "The country here also is "savanna and woodland, intermixed with "thick short hills, especially towards Panama." Wafer says, "The town is surrounded with sa- "vannas, gentle flat hills and copses of wood." Walton says, "A chain of mountains, or Cor- "dilleras, which Humboldt regards as a prolon- "gation of the Andes, runs along the Isthmus, "bending as it inclines, and flanked by other "lofty hills rising on both sides; the hills ex- "tend to within two leagues of the shores of "the South Sea." And again, "The road from "Cruces to Panama does not so much extend "over the heights as it winds round their sides. "For a distance of about four leagues, it rises "and declines, crossing in that space three "small valleys, which have rivulets running "through them. The highest of these moun- "tains is of about an equal height with the "second order of the Alps; but the road winds "across a very small part of its base." Mr. Walton has not explained how this winding across a very small part of its base is recon- cileable with his expression of a chain of mountains, which means a continuous and con- nected range, though not an unvaried ridge of mountain.

The line here described may not be abso-

lutely impracticable for a canal adapted to barges between Cruces and Panama; but as that line may not be fit to form part of a ship canal from sea to sea, "by another route than "that of the river Chagre through the entire "Isthmus," which is the portion of the project that we are now discussing, it is impossible to draw any inference from even the favourable circumstances of the descriptions here given. The practicability of making such a canal may be involved in doubt for want of a survey of the intermediate country; yet this important fact is certain, that if a practicable line and adequate supplies of water do actually exist, such a canal would not be accessible to ships larger than small schooners, for want of a port or harbour for larger vessels on each coast of the Isthmus of Panama; unless Portobello, which is situated nine Spanish leagues eastward from the mouth of the river Chagre, can be made the termination of a canal at the North Sea, in which case it might be expedient to construct a harbour at Panama.

It is, therefore, necessary to give proofs of the difficulty, if not the impossibility of connecting Portobello with the projected canal. Wafer says, "Portobello is a very fair, large and com-"modious harbour, affording good anchoring

" and good shelter for ships; and, at the east " end of the town, the road to Panama goes " out, because of hills that lie to the southward " of the town and obstruct the direct passage. " The east side is low and swampy: from the " south and the east sides the country rises in " gentle hills, which are partly woodland and " partly savanna. Of the country beyond " this, westward, to the mouth of the river " Chagre, I can give no other account, but " only that it is partly hilly, and near the sea " very much swampy; and I have heard, by " several, that there is no communication " between Portobello and the mouth of the " river." Wafer has not specified the nature of the obstacles to such communication; but that they are formidable, may be inferred from the fact he mentions, that the road to Panama commences on the east side of Portobello, and from De Ulloa's description of the latter place, " the mountains surround the whole " harbour, beginning from St. Philip de Poda " Fierro, or the Iron Castle (which is situated " on this declivity), and without any decrease " of height extends to the opposite point."

" The neighbouring country is full of " mountains covered with impenetrable forests. " The heat is excessive, originated by the

" situation of the town, which is surrounded " with high mountains, without any interval " for the winds."

In respect to the line between Portobello and Panama, De Humboldt, as before quoted, observes, " The eastern part of the Isthmus is the " narrowest, but the ground appears to be also " most elevated there; this is, at least, what has " been remarked in the frightful road travelled " by the courier from Portobello to Panama, a " two days' journey, which goes by the village of " Pequene, and is full of the greatest difficulties."

Hence it appears evident, that if it is not impossible, it is highly inexpedient to attempt to make Portobello the termination of a ship-canal across the Isthmus of Panama, even though it should be possible, at vast expense, to extend such a canal from the valley of Chagre, along the shore, between the mountains and the sea, to Portobello, a distance of nine Spanish leagues, in addition to the breadth of the Isthmus.

We may, therefore, conclude with De Humboldt, " that the expectation of a canal, which " like a pass or straight should go from sea to " sea, and admit vessels which sail from Europe " to the East Indies, ought to be completely " abandoned at the Isthmus of Panama;" and,

although we may not entirely concur with Walton, that it is "a delusive speculation," in which "the configuration of the spot and other physical "circumstances render success utterly impos-"sible;" yet we may fully agree with him, "that the bounds of nature alone admit such a "canal to be effected partially;" and, "that the "Isthmus of Panama will at any time become "the point of approximation between Asia and "Europe," appears beyond the hopes of the "most sanguine."

The circumstance of the government of Columbia having recently preferred the Isthmus of Panama for the transit of troops and military stores, is not at all at variance with the view of the obstacles which place that Isthmus low in the scale of practicable routes for a ship-canal, if they do not exclude it altogether from the list. Troops and military stores may be, and often are, landed and re-embarked expeditiously, by means of boats, on beaches and shoal coasts, and sent up or down rivers which are totally unfit for sea-going ships. And the practicability or preference of the intermediate land route, as a line of march for troops, does not at all imply that it affords levels suitable for a canal of any kind. The preference given by the Columbian troops to the route of Panama, may be

fairly attributed to the fact stated by Dampier, that, "about the river Cheapo the country "changes its face, being savanna on the "west-side, though the east-side is woodland;" and, to the fact that the old road across the Isthmus of Panama, which was long used by the Spaniards, though much decayed, is still more practicable for troops and military stores than any other route across a wilderness which may be very favourably circumstanced for other purposes. Besides these reasons, it should be observed, that the district of Panama is now part of the territory of Columbia.

Lest the opinion above quoted from the recent work of Captain Hall should be misapplied to the route between the town of Panama and the town of Cruces on the river Chagre, it is necessary to specify, that "the narrowest "part of the Isthmus" lies between that part of the bay of Panama which is near the mouth of the river Cheapo, on the south, and the bay of Mandingo, which lies within the Samballoe islands, on the north. The opinion alluded to is corroborated by all extant authorities, from which it appears, that, in the narrowest part thus specified, the mountains are higher, more interlocked, and more precipitous, than they are either to the northward or southward of that position. There is not

any port for ships on either side of the Isthmus at the narrowest part. The river Cheapo on the west, and the river Conception on the east, being, according to preceding quotations, barred or shallow and not navigable, and that part of the shore of the bay of Panama is particularly shoal.

Dampier says, "the river Cheapo springs "out of the mountains on the north side of the "country, and being penned up on the south "side by other mountains, bends its course to "the westward between both." Wafer says, "For this river running somewhat northward at "this place, we persuaded ourselves that we "were past the main ridge of land that divides "the north part of the Isthmus from the south, "and consequently that we were not very far "from the north sea. The next day we arrived "at another river, which joined the former; "this last river also we set by the compass, "and found it run due north, which confirmed "us in our mistake that we were on the north "side of the main ridge of mountains. We "travelled over many very high mountains; "at last we came to one surpassing the rest in "height, to which we were four days gradually "ascending, though now and then with some "descent between while. I take this part of "the mountains to have been higher than

" either that which we crossed with Captain
" Sharp (at Darien to the southward), or that
" which Mr. Dampier and the rest of our party
" crossed in their return. When we came to
" the foot of the mountain we found a river
" (Conception) that ran into the north seas;
" the next morning we set forward, and in two
" days' time arrived at the sea side."

The utter want of a port for a canal on either side of the narrowest part of the Isthmus, thus appears. Concerning the east coast, Wafer says, " The long channel between the Samballoes and " the Isthmus is of two, three, and four miles " breadth, and the shore of the Isthmus is " partly sandy bays, and partly mangrove " land, quite to point Samballoes. None of " these outlets (brooks), nor the river of Con- " ception itself, are deep enough to admit of " any vessels but canoes. A sea-wind makes " a great sea sometimes fall in upon the " Isthmus, especially where a channel opens " between the islands, so that I have been over- " set in going ashore in one river, and, in " putting off to sea from another." The west coast of this part of the Isthmus has been well described in former quotations, to which may be added Funnel's assertion, that, "opposite to " the island of Chapelio, near the main, it " is all along shole water, not above four

" foot, though you be a league from the " shore."

The consideration of the climate and diseases of the Isthmus of Panama is deferred to the general section upon those subjects, for the reasons assigned in the foregoing remarks upon the topography of the Isthmus of Darien.

TOPOGRAPHY OF THE ROUTES IN THE PROVINCE OF CHOCO, IN THE KINGDOM OF NEW GRENADA.

Of the routes applicable to navigation in this province, M. De Humboldt, speaks in these terms; "To the south-east of Panama, following the coast of the Pacific Ocean from Cape St. Miguel to Cape Corientes, we find the small port and bay of Cupica. The name of this bay has acquired celebrity on account of a new plan of communication between the two seas. From Cupica we cross, for five or six leagues, a soil quite level and proper for a canal, which would terminate at the embarcadero of the Rio Naipi. This last river is navigable, and flows below the village of Zitara, into the great Rio Atrato which itself enters the Atlantic sea. We almost say, that the ground between Cupica and the mouth of the Atrato, is the only part of all America, in which the chain of the Andes is entirely broken.

"In the interior of the province of Choco, the small ravine Quebrada de la Raspadura, unites the neighbouring sources of the Rio de Noanama, called also Rio San Juan, and

" the small river Quito. The latter, the Rio
" Andageda and the Rio Zitara, form the Rio
" d'Atrato, which discharges itself into the
" Atlantic ocean, while the Rio San Juan
" flows into the South sea. A monk of great
" activity, curé of the village of Novita, em-
" ployed his parishioners to dig a small canal
" in the ravine de la Raspadura, by means of
" which, when the rains are abundant, canoes
" loaded with cocoa pass from sea to sea. This
" interior communication has existed since
" 1788, unknown in Europe. The small canal
" of Raspadura unites, on the coasts of the
" two oceans, two points seventy-five leagues
" distant from one another."

Of these two routes in the province of Choco, Robinson observes; " More than two centuries " ago the Spanish government knew, that, during " the rainy season when the vallies of Choco were " overflowed, canoes passed with produce from " one sea to the other. A monk (the curate of " Novilla) assembled all the Indians of his " parish, and, in a short time, cut a canal " between the rivers Atrato and San Juan, " since called the canal of the Raspadura. " Large canoes (bongos) loaded with cocoa " actually passed through it."

" In the year 1813, the author (Robinson) " conversed with some intelligent Spaniards

"and Creoles at Carthagena, respecting the "Raspadura canal; and they stated that al- "though it is at present choked up with sand "and bushes, yet it might soon be cleared. "They also stated that there were several places "between the sources of the rivers Atrato "and San Juan, where a canal might be "cut by a shorter route than the one which had "been opened by the curate of Novilla. The "distance between the navigable waters of "Atrato and San Juan is only thirteen leagues; "and from the Pacific to the Atlantic ocean, "following the course of the ravines, is only "eighty leagues. No doubt therefore can exist, "that a water communication between the two "oceans might be accomplished in the pro- "vince of Choco, by either opening the former "canal of Raspadura, or by cutting a new one "between the two rivers we have mentioned. "This communication would certainly not ad- "mit the passage of vessels of large burthen, "owing to impediments in the two rivers, and "to the shallowness of the water on the bars at "their mouths; but as the ordinary purposes of "commerce could be answered by the use of "large flat-bottomed boats, this route merits "great consideration; and it will, doubtless, at "some future period, be the channel of an "important commerce."

" Besides this route, there is, in the same " province, another, and, as we were informed, " a preferable one, by the river Naipi, which " empties itself into the Atrato, of which indeed " it is only a branch. From the port of Cupica, " on the Pacific Ocean, to the head of the navi- " gable waters of the Naipi, is only twenty- " four miles, and the country between the two " places is a dead level. A canal might, there- " fore, be cut there without difficulty. The course " of the Naipi is stated to be very circuitous, and " makes the distance of the navigation a few " leagues longer than by the route of the Ras- " padura; but the circumstance of the waters " of the Naipi being so near the port of Cupica, " gives to this route an important advantage. " The want of correct topographical knowledge " prevents us from forming an opinion upon " the merits of these two routes; but there " cannot exist a doubt, that by either of them " a communication between the two oceans " may be established for the navigation of " boats; and it is possible, that, at some future " period, when population becomes dense, and " a free trade shall be permitted between the " inhabitants of the Atlantic and Pacific shores, " the province of Choco may then afford a " channel for the navigation of large vessels."

REMARKS ON THE TOPOGRAPHY OF THE ROUTES IN THE PROVINCE OF CHOCO.

It is unnecessary to discuss the limited facilities of the routes for navigation offered by the province of Choco, even though it may be, as Humboldt observes, "the only part of all "America in which the chain of the Andes is "entirely broken." The able writers, to whom we are indebted, for the above descriptions of these routes, do not intimate that they can ever be made adequate to ship navigation. A conclusion which is warranted by this fact alone; namely, that the Rio Atrato is either the same river that is called in our maps the river Darien, or else it flows into the latter, above the bar on which Dampier states, as quoted in the section upon the Isthmus of Darien, there are "not above six foot of water on a "spring tide, for the tide riseth but little here." Even if the shoalness of the mouth of the river Atrato or Darien, was not fatal to the design of forming a canal for ships from sea to sea, it might yet be impossible to complete such a canal; because it might justly be apprehended that the sources of the rivers Atrato, San Juan, and Naipi, would not supply the summit level

of the canal with the quantity of water that would be requisite for the considerable number of ships which we must presume and expect, would pass through the canal.

In that case, it would be necessary to sink the summit level to a considerable depth and for a great length, to meet and receive the waters of those rivers lower down in their channels, where their streams might be so large as to furnish adequate supplies of water. That species of work would be laborious and expensive, in proportion to its great magnitude, even if it would secure an ample supply of water. But of the sufficiency of those rivers to furnish it, there is reason to doubt, as De Ulloa says, that "in the season of the brisas or N. E. winds, the rivers which discharge into the gulf of Darien are low, and so weak, that the current of the sea overcomes their resistance." Hence it is manifest that the province of Choco is incapable of being intersected by a ship canal.

These routes in the province of Choco are comprised in this work for the reason before assigned; namely, that it may contain all the navigable routes which by common report are found in the Isthmus of America.

The nature of the climate and diseases of the province of Choco, will be described in the general section upon those topics.

TOPOGRAPHY OF THE ISTHMUS OF TEHUANTEPEC.

This Isthmus is situated between the river Guasacualco, which flows into the gulf of Mexico, and the river of Tehuantepec, which flows into the South Sea.

The following notice of the river Guasacualco is contained in Dampier's account of his voyage to the bay of Campeachy and parts adjacent.

"From Tondelo river to the river of Guasick-walp is eight leagues, the coast still west, all along sandy bay and sand hills, only towards the west part the bank is lower and the trees higher. This is one of the principal rivers of this coast; 'tis not half the breadth of the Tobasco river, but deeper. Its bar is less dangerous than any on this coast, having fourteen feet of water on it, and but little sea; within the bar there is much more, and soft oasie ground. The banks on both sides are low; the east side is woody, and the west side savanna. This river hath its rise near the South Sea, and is navigable a great way into land, especially with boats or small barks."

"The river Teguantepeque, that falls into

" the South Sea, has its origin near the head
" of Guasickwalp ; their heads are not above
" ten or twelve leagues asunder.

" The town of note on the South Sea, is
" Teguantepeque, and on the North Sea
" Keyhooca is the chiefest near this river.
" Keyhooca is about four leagues from the
" river Guasickwalp on the west side. This
" country is pleasant enough in the dry season;
" but when the furious north winds rage on
" the coast, and violently drive in the sea, it
" suffers extremely, being so much overflown
" that there is no travelling.

" From the river Guasickwalp the land runs
" west two or three leagues, all low land, with
" sandy bay to the sea, and very woody in the
" country."

Of the coast of Tehuantepec he gives the following description:

" There we had a perfect view of a pleasant
" low country which seemed to be rich in pas-
" turage for cattle. It was plentifully furnished
" with groves of green trees, mixed among the
" grassy savannas. Here the land was fenced
" from the sea with high sandy hills, for the
" waves all along this coast run high, and
" beat against the shore very boisterously,
" making the land wholly unapproachable in
" boats or canoes."

William Funnel, whose account of his voyage to the South Sea is already quoted, but whose accuracy in geography has been questioned on some points by Dampier, says, "We found ourselves abreast of the bay of "Tecoantepeque, which is very low land, and "full of little hills which look like small "islands. This place is very subject to hard "gales of wind at N. E., called Tecoantepe-"quers, from the place whence they come, and "they happen commonly about the new and "full moons. The best way, therefore, is to "keep near the shore after you are past the "bay or gulf. In the gulf itself you may keep "three or four leagues off, for it is shoal to that "distance. But when you are to the westward "of the bay, keep within two leagues of the "shore, that you may come to an anchor if "occasion be. For if you should chance to be "driven off from the shore, which frequently "happens, you will hardly be able to get in "four days, so much as you will drive out in "one; for when you are driven out of sight of "the land, you will have a strong current, "which will drive you far to the S. W.

"From the mount of Mazatlan to the port of "Salinas is four leagues. By this Salinas, "the low land beginneth; here is an abun-"dance of salt, and the inhabitants of Teco-

"tantepeque bring hither abundance of meat, "tallow, and hides to sell. From this port "many commodities are shipped for the "South Sea, to the great enriching of the "town, which consists of about fifty houses of "merchants, who have the advantage of trading "in the North and South Seas. They trade "from the North Sea, up the river of Guasicke-"walp in small barks, and then have but thir-"teen leagues hither, good road as is said, so "that waggons pass it.

"Five or six leagues from hence (Port Sa-"linas) is the great town of Tecoantepeque. "All along here the coast is very populous, and "great store of pearl is found near the shore "in the bay of Tecoantepeque, which is a "good port, but much subject to N. and N. E. "winds which at certain times blow very hard. "When you are off this port of Tecoantepeque, "do not come nearer the land than two leagues. "For eight leagues it is all along shallow "water; but if you have occasion, send in "small boats or canoes. It is all along low "land, excepting the hill Carbon, which is a "round hill almost like a sugar-loaf. Near it "is the river of Tecoantepeque, on the banks "of which the town is situated. In going into "this river, you must go over a bar of sand; "near unto which bar are some small hills

" that lie a little within the low land in the " river, and are islands. When they appear to " you like hills, you may know it to be the " bar, and on the N. E. is the channel. This " Tecoantepeque is a harbour for small vessels." Funnel having, in the last quotation, described the bay of Tecoantepeque as a good port, and stated, " that the river of Tecoantepeque has a " bar of sand, and is a harbour for small " vessels ;" it is necessary to observe, that the sketch-map of this coast, which is inserted in Funnel's narrative, separates the port from the river Tecoantepeque, and places the Morro del Carbon (or hill of Carbon) between them, and the port of Salinas still farther off from the river to the westward.

De Humboldt, whom we always quote with the pleasure arising from well-merited confidence, thus writes concerning this route. " The " Isthmus of Tehuantepec to the S. E. of the " port of Vera Cruz, is the point of New Spain " in which the continent is narrowest. From " the Atlantic Ocean to the South Sea the " distance is 45 leagues. The approximation " of the sources of the rivers Huasacualco* and " Chimalapa, seems to favour the project of a " canal for interior navigation : a project with

* Or Guasacualco.

"which the Count of Revillagigedo, one of the "most zealous viceroys for the public good, "has been for a long time occupied. A survey "of the Isthmus of Guasacualco, the lake "Nicaragua, of the country between Cruces "and Patiana, and between Cupica and the "Rio Naipi, would direct the statesman in his "choice, and enable him to decide if it is at "Mexico or Darien that this undertaking "should be executed: an undertaking calcu-"lated to immortalize a government occupied "with the true interests of humanity."

"This is the place to speak more amply "than we have already done, of the project of "a canal, for the union of the two seas, in the "Intendancy of Oaxaca: a plan which is every "way worthy of fixing the attention of the "government. After the taking of Mexico, "this Isthmus (Tehuantepec or Teguante-"peque) was looked upon as of very great "importance; because the proximity of the two "seas and the river Huasacualco afforded a "facility in transporting to the coast of the "Pacific Ocean, materials for the construction "of vessels.

"Since the end of the sixteenth century, the "Port of Tehuantepec (which is impeded by "a very dangerous bar, and hardly deserves

" the name of road), has been very little fre-
" quented. The sea is daily withdrawing from
" the coast of Tehuantepec; the anchorage is
" yearly becoming worse, and the sand brought
" down by the river Chimalapa, augments
" both the height and extent of the bar. At
" present, the distance from the Villa de
" Tehuantepec to the sea, is four leagues by the
" way of the Hacienda de la Zoleta, and the
" best anchorage is at the Morro del Carbon
" at the salt pits, and in the Laguna de Santa
" Teresa.

" The viceroy, Don Antonio Bucarelli, gave
" orders to two able engineers, Don Augustin
" Cramer and Don Miguel del Corral, to ex-
" amine with the greatest minuteness the
" country between the bar of Huasacualco and
" the road of Tehuantepec. From the itinerary
" journals of these two engineers, I drew up
" my map of the Isthmus of Tehuantepec. They
" found that no river discharges its waters at
" the same time into the South sea and Atlantic
" ocean; that the Rio Huasacualco did not
" take its rise, as the viceroy had been inform-
" ed, near the town of Tehuantepec; and that
" on ascending it beyond the cataract, even as
" far as the old disembarcadero de Malpasso,
" they were still more than twenty-six leagues
" distant from the shores of the South sea.

" They observed that a chain of mountains, of
" very inconsiderable height, divides the waters
" between the gulf of Mexico and the gulf of
" Tehuantepec. This small Cordillera stretches
" from east to west, from the Cerros de los
" Mixes, towards the elevated table-land of
" Portillo de Petapa. The engineer Cramer
" affirms, that to the south of the village of
" Santa Maria de Chimalapa, the mountains
" form rather a group than an uninterrupted
" chain; and that there exists a transversal val-
" ley, in which a canal of communication might
" be cut between the two seas. This canal, which
" would unite the Rio de Chimalapa with the
" Rio del Passo (or Malpasso), would be only
" six leagues in length: the boats would ascend
" the Rio Chimalapa, which affords a very
" easy navigation from Tehuantepec to the
" village of San Miguel, and from thence they
" would pass by the canal projected in the
" time of Count Revillagegedo, to the Rio del
" Passo. This river discharges itself into the
" Rio de Huasacualco, near the Bodegas de la
" Fabrica; but its navigation is extremely
" difficult, on account of the seven raudales*
" which are counted between its source and
" the mouth of the Rio de Saravia.

" It would be of infinite importance again

* Rapids or falls.

" to order this ground to be examined by
" intelligent engineers, to determine whether,
" as was believed by Cramer, the canal
" between the two seas can be executed with-
" out locks or without inclined planes; and
" whether, by blowing up the rocks with pow-
" der, the beds of the rivers Passo and Chima-
" lapa can be deepened. To avoid the seven
" rapids of the Rio del Passo, a new port
" (disembarcadero) was established in 1790, at
" the mouth of the Rio Saravia. A road has
" been opened from Tehuantepec by Chihui-
" tan, Lluno Grande, Santa Maria Petapa and
" Guchicovi to the new port of La Cruz: they
" reckon the road thirty-four leagues. In 1804,
" at my departure from New Spain, the carriage
" of goods on the backs of mules from Tehu-
" antepec to Vera Cruz, by Oaxaca, amounted
" to thirty piastres per load;* and the mule-
" teers took three months in going a road
" which is not seventy-five leagues in a straight
" line. I have thought it important to publish,
" in the greatest detail, every thing relative to
" the projected communication between the two
" seas. The topography of the Isthmus of Te-
" huantepec is altogether unknown in Europe;
" and, from authorities which I have quoted,
" we cannot doubt that this point of the globe

* " £6. 6s. sterling."—*Trans.*

" deserves no less attention than the lake of " Nicaragua."

Robinson, following on the same branch of the subject, writes thus: " We will now pro- " ceed to examine another, which (route for a " canal) although it is deficient in some of the " natural advantages of Corta Rica, still pos- " sesses others of so important a character, " as to render it almost doubtful with us at " which of the two places the desired com- " munication ought first to be opened. Were " we to consult the present and future interests " of Mexico, and of the Republic of the " United Sectes, we should say, that the Mex- " ican Isthmus (or Isthmus of Tehuantepec) " is the station where the communication " should be made. But, as we are desirous of " seeing the blessings of commerce extensively " diffused for the benefit of the human race, " generally, and not of any nation in particu- " lar, we should rejoice to see the communica- " tion between the two seas simultaneously " opened at every place where it is practicable, " whether by land or water, or by the latter " solely, thereby exciting emulation and widen- " ing the range of commercial enterprize. " We wish to see the two great oceans of our " globe brought nearer to each other, by " canals and high roads, at such places as

" the God of nature has evidently destined
" for channels of communication; and, that
" they should no longer remain dark and
" dreary deserts, such as they have been for
" ages.

" The narrowest part (of this Isthmus) is
" between the port of Guasacualco in the
" gulf, and the bay of Tehuantepec on the
" Pacific ocean. A chain of mountains, which
" may be termed a continuation of the Andes,
" runs through the centre of this Isthmus, the
" elevation of which, above the ocean, varies
" from five or six thousand to three or four
" hundred feet. From some extraordinary
" convulsion of nature, vast chasms or ravines
" have been formed among these mountains,
" which we shall hereafter speak of, as it is by
" means of those fissures that nature appears
" to point out to man the practicability of form-
" ing a water communication between the two
" seas. During the rainy season these chasms
" contain a vast body of water, which seeks
" its discharge by rivers flowing into the
" Pacific and Atlantic oceans. The Indians
" of the Isthmus, particularly those of Tobasco
" and Tehuantepec, assert that they pass with
" their canoes entirely through the Isthmus.
" We endeavoured, while at Oaxaca, to ascer-

" tain this fact, and we are convinced, that " when the waters are at their height during " the rainy season, a canoe may pass by the " sinuosities of the ravines, from the river " Guasacualco to the rivers Chimalapa and " Tehuantepec. The sources of these three " rivers are within five leagues of each other. " We will not positively assert that a navigable " canal may be formed so as to unite the " waters of these three rivers, but we believe " it practicable. The point will be decided " when the Isthmus shall, hereafter, be pro- " perly surveyed.

" At the mouth of the river Guasacualco, is " the most spacious and secure harbour of any " on the Atlantic coast of Mexico. It is the " only port in the Mexican gulf, where vessels " of war, and others of a large size, can enter, " and is far superior either to Pensacola or " Espiritu Santa. There are at all seasons, on " the bar, at the mouth of that port, twenty- " two feet water; and it is said, that during " the flood of the river, the bar occasionally " shifts, and affords passages in five and six " fathoms water.

" The river Guasacualco is navigable for " vessels of the largest size, to within twelve " leagues of the navigable waters of Chimalapa

" and Tehuantepec: the latter river admits, " from the Pacific Ocean, vessels drawing " twenty feet of water. No doubt therefore " exists that the Isthmus of Tehuantepec, can " be entered on the Pacific and Atlantic coasts, " by the rivers before-mentioned; and, if on a " topographical survey of the Isthmus, it shall " be found practicable to cut a canal, there is " no place where such an undertaking could " be accomplished with such ease as in the " province of Oaxaca. In its boundaries are " comprehended a great part of the Isthmus of " Tehuantepec. Its salubrity is unequalled on " the American continent; even its shores " on the Pacific Ocean, appear exempted " from the usual diseases which afflict the " inhabitants of the Atlantic and South Sea " Coasts.*

" The population of Tehuantepec which is " situated on the river, only six leagues from " the ocean, and about the latitude of 16° 30′, " are among the most active and healthy race " of Indians we have ever seen, and the cutting " of a canal through such parts of the Isthmus,

* See, however, a passage, at variance with this, in vol. ii, page 152.—" Along the coast of Oaxaca, the climate is destructive of " health; but the greater part of the province, and particularly " the mountains of the Misteca, are famed for their pure and salu- " brious air." Vide sue, on Climate and Diseases.

as an accurate survey shall show to be fittest
" for that purpose, could be performed with
" the greatest facility by the inhabitants of
" Oaxaca. The idea of such an undertaking
" has long been familiar to several enlightened
" men of Oaxaca. So early as the year 1745,
" a memorial was presented to the Viceroy of
" Mexico, signed by several distinguished Cre-
" oles; in which, after giving a topographical
" description of the Isthmus of Tehuantepec,
" the memorialists explicitly declare, that a
" canal can be cut, so as to unite the waters of
" the rivers before-mentioned. The superior
" advantages of the port and harbour of Gua-
" sacualco over that of Vera Cruz, and the
" number of valuable ports on the coast of
" Oaxaca are then noticed, and of the latter,
" they particularly mention Tehuantepec.

" In viewing the map, we perceive that the
" Isthmus of Tehuantepec, and the Isthmus of
" Costa Rica are the two great points at which
" to concentrate the commerce of the new world.
" It is immaterial at which of these two points
" the communication be first opened. If both
" communications be simultaneously opened,
" we conceive there will be no want of com-
" merce, to render the districts through which
" they will pass, flourishing in the highest

" degree. In fact, it is impossible for the ima-
" gination to form any proper conception of
" the magnitude of the commerce that will pass
" through the Isthmus of Tehuantepec, when
" Mexico and South America shall enjoy the
" blessings of liberal governments."

REMARKS ON THE TOPOGRAPHY OF THE ISTHMUS OF TEHUANTEPEC.

The obvious contradictions upon matters of fact between the above-cited authorities, make it impossible to assume any of the alleged facts as certain, or to draw any safe inference from those premises, without a survey of the harbours on each coast, and of the heights and levels of the intermediate country. For example; though in general accurate, Dampier says, "This (Guasickwalp) is one of the principal "rivers of this coast (the North coast). Its "bar is less dangerous than any on this coast, "having fourteen feet water on it, and but little "sea;" yet Robinson, who had opportunities for acquiring correct information, says of Guasacualco, "There are at all seasons, on the bar, at "the mouth of that port, twenty-two feet water; "and it is said, that during the flood of the "river the bar occasionally shifts, and affords "passages in five and six fathoms of water." These latter words, on the effect of occasional floods in the river, deprive us of the only means of reconciling those inconsistent assertions of Dampier and Robinson, as to the depth of the water on the bar of the river.

Equally irreconcileable are the descriptions above given of the gulf, river, and port of Tehuantepec, on the south coast of this Isthmus. Funnel says, "We found ourselves abreast of "the bay of Tecoantepec. The best way is "to keep near the shore, after you are past "the bay or gulf. *In the gulf itself you may "keep three or four leagues off, for it is shole "to that distance. But when you are to the* "westward of the bay, keep within two leagues "of the shore, that you may come to an an-"chor if occasion be." And yet elsewhere, he says, "Great store of pearl is found near the "shore in the bay of Tecoantepec, which "is a good port;" and, notwithstanding, adds, "When you are off this port of Tecoantepec, "do not come nearer the land than two "leagues. For eight leagues it is all along "shallow water; but if you have occasion, "send in small boats or canoes."

Of the river of Tecoantepec itself, he says, "In going into this river, you must "go over a bar of sand. This Tecoantepec "is a harbour for small vessels." Funnel has thus pronounced the Bay of Tehuantepec a good port, though it is on a shoal coast; its river is barred, and it is only a harbour for small vessels. The latter description is confirmed;

however, by a collateral fact which he mentions, respecting the neighbouring port of Salinas; he says, "The inhabitants of Tecoantepec bring hither a great abundance of meat, tallow, and hides to sell. From this port, many commodities are shipped for the South Sea." Now, if Tecoantepec was not a barred and shallow harbour, the inhabitants would not have occasion to use the port of Salinas. If the above inconsistent statement cannot be reconciled by the fact of the port and river of Tehuantepec being distinct from each other, according to Funnel's sketch map, as mentioned in the last section, they may be considered as some of the geographical inaccuracies with which he was charged by Dampier.

Humboldt confirms the main bearing of Funnel's description, by saying that, "Since the end of the sixteenth century, the port of Tehuantepec (which is impeded by a very dangerous bar, and hardly deserves the name of road,) has been very little frequented. The sea is daily withdrawing from the coast of Tehuantepec, the anchorage is yearly becoming worse, and the sand brought down by the river Chimalapa augments both the height and extent of the bar." But we find

Robinson in opposition to both these authorities, stating, that the river Tehuantepec "admits "from the Pacific Ocean, vessels drawing "twenty feet water."

There will appear, however, to be good reasons for rejecting the authority of Robinson as to both the ports of Tehuantepec and Guasacualco; not merely in comparison with the writers above quoted, but from an examination of his authority upon the next topic of this subject, namely, the local facilities of this Isthmus for making "a canal of communication between "the two seas."

With reference to this topic, we recur to Dampier's words; "This river (Guasickwalp) "hath its rise near the South Sea, and is navi- "gable a great way into land, especially with "boats or small barks." Funnel says, "From "this port (Salinas) they (the merchants of "Tecoantepec) trade from the North Sea "up the river of Guasickwalp in small barks, "and then have but thirteen leagues hither, "good road, as is said, so that waggons pass "it." Thus it appears, that Dampier and Funnel only considered the Guasickwalp as adequate to boats or small barks, for a great part of its navigation. De Humboldt identifies the Rio Chamalapa with the Rio Tehuantepec, as one and the same river, by saying, "the sand

" brought down by the river Chimalapa aug-
" ments both the height and extent of the bar :"
that is, of the port of Tehuantepec, and adds;
" the boats would ascend the Rio Chimalapa;
" which affords a very easy navigation from
" Tehuantepec," expressly contemplating only
a boat navigation upon that river; and yet,
Robinson says, " The river Guasacualco is navi-
" gable for vessels of the largest size, to within
" twelve leagues of the navigable waters of
" Chimalapa and Tehuantepec." He does not
indeed say that the river Chimalapa is navi-
gable in the same degree as the Tehuantepec,
which he asserts, as before quoted, admits from
the Pacific Ocean vessels drawing twenty feet
water; but, if they are different rivers, or dif-
ferent branches of the same river, he encourages
the belief that the former river might be made
as capable as the latter of ship navigation.
Yet, he afterwards qualifies those intimations
down to a mere facility of making a route for
the transit, and transhipment of goods; by the
words, " We have stated that large vessels can
" enter the rivers Tehuantepec and Guasa-
" cualco, and ascend the same to within about
" fourteen leagues of each other. We have
" shown that a good carriage-road could be
" promptly made, so as to transport property
" of every kind to and from the respective

" rivers," and he adds, " We are convinced, that " when the waters are at their height, during " the rainy season, a canoe may pass by the " sinuosities of the ravines, from the river " Guasacualco, to the rivers Chimalapa and " Tehuantepec. The sources of these three " rivers are within five leagues of each other. " We will not positively assert that a navigable " canal may be formed, so as to unite the " waters of these three rivers, but we believe it " practicable. The point will be decided, when " the Isthmus shall be properly surveyed."

Much more guarded, but not more encouraging, are the the remarks of De Humboldt upon this Isthmus, as he leaves it to be determined by a future survey, whether there exists, as believed by the engineer Cramer, " a transversal valley, in which a canal of communication might be cut between the two seas, " which would unite the Rio de Chimalapa, " with the Rio del Passo, would only be six " leagues in length," and " could be executed " without locks or without inclined planes." Humboldt then declares that, " The topography " of the Isthmus of Tehuantepec is altogether " unknown in Europe."

Exclusive, however, of these controverted and unascertained facts, those topographical descriptions specify several points upon which

opinions may be formed, with reference to the general question, as to the practicability of intersecting the Isthmus of Tehuantepec, with a ship-canal from sea to sea.

If Dampier be correct in stating that the river Guasickwalp has but fourteen feet water on its bar in general, even though it may be deeper after floods, that river would not admit the larger classes of merchant-ships. It is besides fully admitted, that the river Guasacualco is subject to floods, so violent that they sometimes shift the bar, and occasionally deepen the water on it one-half more, upon an average, than the depth of the water in the ordinary state of the bar. A river partaking at times of the character of a mountain-torrent, and whose current or stream is not materially alternated by tides, which have very little influence in the gulf of Mexico, cannot be suitable or very safe for ship-navigation. So rapid a river must have a considerable descent in some part of the line of its bed or channel; and if the rapidity of the current reaches to the sea, with such force as to remove the bar, the descending portion of the bed or channel cannot be very distant from the bar, and the deep water of such a river cannot extend very far within the land. Now the river Guasacualco, has all these characteristics, and there-

fore it is not likely that its bed would constitute any very material portion of the projected ship channel. The greater part, or nearly the whole of it should therefore be made by art in the transversal valley mentioned by Cramer. It is scarcely to be supposed that this valley, if it exists, can be sufficiently deep to admit of a ship canal being made "without locks or with-"out but inclined planes," because that transversal valley is described as being above the rapids the Rio del Passo. Its elevation shows that it joins those rivers near their sources, where it may not have adequate supplies of water for its summit level. On the other hand it may be subject to floods and inundations from the "vast body "of water which seeks its discharge by rivers "flowing into the Pacific and Atlantic Oceans." It may for this reason be necessary, yet impossible, to provide adequate vents for those torrents, to prevent their disturbed waters from injuring the canal. Large reservoirs must also be constructed for receiving and reserving the increase of those rivers to supply the summit level of the canal in seasons of drought. These would be stupendous works; and even if they could be completed on a scale adequate for sea-going ships, there is still another difficulty, That very transversal valley, if it exists, is one of the main conduits for those violent winds

from the N. and N. E. which make the gulf of Tehuantepec so noted for storms, that they are called, from its name, Tecoantepequers. These furious winds would greatly obstruct the passage of a ship, with her masts and rigging set up, from the South Sea to the North, on such a canal, through so deep a valley or ravine; and would render the passage of any vessel, from the North to the South Sea, dangerous, from its too great velocity. In many instances, ships would be cast away upon the banks of the canal, or would break down the works, and cause the destruction of property and the loss of lives.

If to these obstacles be added the want of ports on both coasts, adequate to the larger classes of merchant ships, the aspect of the project at this Isthmus is very discouraging. Possibly an artificial harbour, to terminate the canal on the north, might be constructed in deeper water, outside of the bar of the river Guasacualco; for, as Dampier says "there is "but little sea on the bar," some shelter must be afforded by the adjoining coasts. It may also be practicable to extend the southern extremity of the canal to the Laguna de Santa Teresa, which Humboldt specifies as one of the best anchorages near Tehuantepec; but we are still ignorant of the soundings and shelter

afforded by that Lagune. Under all these conflicting authorities and discouraging circumstances, it seems very improbable that the Isthmus of Tehuantepec will ever become the scene of that immense and universal commerce which Robinson anticipates, by means of a ship-canal. It undoubtedly possesses important capabilities for becoming, by means of a boat navigation, a place of *entrépôt* and transshipment: but that consideration is entirely foreign to the express object of this work.

It is not intended by these observations to pronounce definitively upon the facilities or impediments of this route, M. de Humboldt having declared that "The Topography of the Isthmus "of Tehuantepec is altogether unknown in "Europe."

The nature of the climate and diseases of the Isthmus of Tehuantepec will come under notice in the general section upon those topics.

TOPOGRAPHY OF THE ISTHMUS OF NICARAGUA.

THE notices contained in the narratives of the voyages of Dampier, and others of the buccaneers, on the coasts of this most remarkable Isthmus (for none of them travelled across it), are to the following effect:—

"From the Cape (Blanco N. lat. 9° 56′) on "the N.W. side, the land runs in N. E. for "about four leagues, making a small bay, called "by the Spaniards, Caldera. A league within "Cape Blanco, on the N.W. side of it, and at "the entrance of this bay, there is a small "brook of very good water, running into the "sea. Here the land is low, making a sad-"dling between two small hills. It is very rich "land, producing large trees of many sorts; "the mould is black and deep, which I have "always taken notice of to be a fat soil. About "a mile from this brook towards the N. E. the "woodland terminates. Here the savanna land "begins, and runs some leagues into the coun-"try, making many small hills and dales: those "savannas are not altogether clear of trees.

"Toward the bottom of the bay, the land "by the sea is low and full of mangroves; but,

" further in the country, the land is high and " mountainous: the mountains are part wood- " land, part savanna. From the bottom of this " bay it is but fourteen or fifteen leagues to the " lake of Nicaragua on the North Sea coast: " the way between is somewhat mountainous, " but most savanna."

" Nicoya is a small mulatto town, about " twelve or fourteen leagues east from hence " (bay of Caldera), standing on the banks of a " river of that name: it is a place very fit for " building ships; therefore, most of the inhabi- " tants are carpenters.

" By the sea-side, in some places, there grew " some red wood, useful in dyeing; of this they " (two Spanish Indians) said there was little pro- " fit made, because they were forced to send it " to the lake of Nicaragua, which runs into the " North Seas. That they sent thither, also, great " quantities of bull and cow-hides, and brought " from thence in exchange Europe commo- " dities."

" We sailed from this bay of Caldera, direct- " ing our course for Ria Lexa: the wind was " at N., which, although but an ordinary wind, " yet carried us, in three days, abreast of our " intended port. Ria Lexa is the most re- " markable land on all this coast; for there is " a high-peeked burning mountain, called by

" the Spaniards, Volcan-Vejo, or the Old Vol-
" can; this must be brought to bear N. E.;
" then steer in directly with the mountain, and
" that course will bring you to the harbour.
" The sea-winds are here at S. S. W.; there-
" fore the ships that come hither must take the
" sea-winds, for there is no going in with the
" land-wind. This mountain may be seen
" twenty leagues, being within three leagues of
" the harbour; the entrance into it may be seen;
" there is a small, flat, low island which makes
" the harbour; it is about a mile long, and a
" quarter of a mile broad, and is from the main
" about a mile and a half. There is a channel at
" each end of the island; the west channel is
" the widest and safest, yet at the N.W. point
" of the island, there is a shole which ships
" must take heed of going in. Being past that
" shole, you must keep close to the island; for
" there is a sandy point strikes over from the
" main almost half-way. The east channel is
" not so wide; besides, there runs a stronger
" tide, therefore ships seldom or never go in
" that way. This harbour is capable of re-
" ceiving two hundred sail of ships; the best
" riding is near the main, where there is seven
" or eight fathom water, clean hard sand.

" Ria Lexa town is two leagues from hence
" (from the anchorage in the port); and there

" are two creeks that run towards it: the " westernmost comes near the back-side of the " town; the other runs up to the town, but " neither ships nor barks can go so far. These " creeks are very narrow, and the land on each " side drowned, and full of red mangrove trees.

" A man can't pass through red mangroves " but with much labour.

" We sailed from Quibo (near the bay of " Panama), bending our course for Ria Lexa, " which is the port for Leon; we coasted along " shore, passing by the gulf of Nicoya, the " gulf of Dulce, and by the island Caneo. All " this coast is low land, overgrown with thick " woods, and there are but few inhabitants " near the shore. The creek which leads " towards Leon lieth on the S. E. side of " the harbour, and is very narrow; the " land on both sides lying so low, that every " tide it is overflown with the sea. This sort " of land produceth red mangrove trees, which " are here so plentiful and thick, that there is " no passing through them. Beyond these man- " groves, on the firm land, close by the side of " the river, the Spaniards have built a breast- " work, to hinder an enemy from landing.

" The city of Leon is twenty miles up in " the country; the way to it plain and even, " through a champion land of long grassy

" savannas and spots of high woods. About
" five miles from the landing-place, there is a
" sugar work; three miles farther there is
" another; and two miles beyond that there
" is a fine river to ford, which is not very deep;
" besides which, there is no water in all the
" way till you come to an Indian town, which
" is two miles before you come to the city, and
" from thence it is a pleasant, straight sandy
" way to Leon. The city stands in a plain
" not far from a high-peeked mountain, which
" oftentimes casts forth fire and smoke from
" its top; it may be seen at sea, and is called
" the Volcan of Leon. Mr. Gage, who tra-
" velled in those parts, recommends it (Leon)
" to the world, as the pleasantest place in all
" America, and calls it the paradise of the
" Indies. Indeed, if we consider the advantage
" of its situation, we may find it surpassing
" most places for health and pleasure in Ame-
" rica; for the country about it is of a sandy
" soil, which soon drinks up all the rain that
" falls, to which these parts are much subject.
" It is encompassed with savannas, so that they
" have the benefit of breezes coming from any
" quarter; all which makes it a very healthy
" place."

" The creek that leads to Ria Lexa, lieth
" from the N. W. part of the harbour, and it

"runs in northerly. It is about two leagues "from the island, in the harbour's mouth, to the "town. Two-thirds of the way it is broad; "then you enter a narrow deep creek, bordered "on both sides with red mangrove trees, whose "limbs reach almost from one side to the other. "A mile from the mouth of the creek, it turns "away west; there the Spaniards have made "a very strong breast-work. There we landed, "and marched to the town of Ria Lexa or "Ria Lejo, which is about a mile from hence, "and stands on a plain by a small river. This "is a very sickly place, for it is seated so nigh "the creeks and swamps, that it is never free "from a noisome smell: the land about it is a "strong yellow clay, yet where the town stands "it seems to be sand."

William Funnel, whose work is before quoted, has the following observations on the southern shore of this Isthmus: "The port "of Marten Lopez, a fine port, is very seldom "made use of, for want of trade; from this port "to the S. E., distance four leagues, is the port "of Ria Lexa, by some called Ria Leon. It "is a good and safe port from all winds: if you "would enter this port, keep the largest of the "two islands on the larboard side; this island, "which you must leave on the larboard side, is

" all savanna and when you are within it,
" bear off from the land on the starboard side,
" for from the main come many dangerous
" shoals: then sail directly to the anchoring-
" place, which is right against a small river
" on the said island, and is three leagues before
" you come to the river. At the anchoring-
" place the harbour is pretty broad; but from
" thence it turns away to the west, and grows
" narrower till you come to the town, which is
" situated upon the river Lexa or Leon.

"This port of Ria Lexa is a place of great trade
" from most parts of Peru and Mexico, and is sel-
" dom or never without shipping: in it they build
" small vessels, and some ships of 250 tons. This
" port lies in latitude of about 12° 40'. N.; long.
" from London 97° 10'. The islands are very
" low, so that every tide they are overflown;
" and upon this low and swampy land are abun-
" dance of mangrove trees."

"From the mountain of Martiare to the
" port of St. John is five leagues. In this
" port they commonly build small vessels; but
" here often runs so great a sea that no boat
" can go ashore unless by chance. This is a
" pretty good port, and in it you are de-
" fended from the north-west and other nor-
" therly winds. At the east point of this port

" lie four small islands, or rather rocks, which " make a good defence for the port against the " south-east winds; and at the bottom of the " port, in the middle, is a river of fresh water. " From hence to the point of St. Catherine is " fifteen leagues, and between them is the gulf " of Papagayo; *an ill place to go ashore in, and* " *worse to ride in,* being very windy, but es- " pecially from April to the latter end of Sep- " tember, which is the time for the north winds. " From this gulf you will see within land the " great Volcan of Grenada, and near the sea-side " stands the great Volcan of Bombacha. In " the middle of the gulf is a river of fresh " water, but the sea falls with so great force " on the shore, that there is no landing near it. " In the middle of the gulf, by the sea-side, the " land is low, till you come to the great moun- " tain of Papagayo, which is a vast high moun- " tain, and is in the form of a sugar loaf. This " mountain stands upon the point of St. Cathe- " rine, which is low land."

" Herrardura is the south point that makes " the gulf of Nicoya, as Cape Blanco is the " north; we arrived at Herrardura, but passed " by it, and went further into the gulf till we " came to many small islands, called by the " Spaniards the Middle Islands, because they lie " in the middle of the gulf.

" In this gulf are the island of St. Lucas, and " the island of Chira: to this latter island, the " Spanish ships come to take in their lading, " which is brought from Nicoya (distant about " ten leagues). Observe, when you enter into " this gulf, that you leave all the islands to " the westward, except the island Guabiabas. " Amongst the Middle Islands is a good har- " bour, in which we wooded, watered, and hauled " our ship ashore. We found the water here, at " neap tides, to rise and fall eight foot; at spring " tides, more. From the Middle Islands to the " island of Chira is clear ground, and six or " seven fathom water. When you sail up the " gulf, you must sail nearer the islands than " the main land, because near the main are " several shoals, which stretch a considerable " way."

The Appendix to the last edition of the " History, Civil and Commercial, of the British " West Indies, by Bryan Edwards, Esq." contains the following passage upon lake Nicaragua and the adjacent coasts:

" I have been assured, if I am not greatly " deceived in my recollection, that a vessel of " thirty tons has sailed up to the entrance of " this lake, which very vessel afterwards made " a voyage to Jamaica. From the interior " boundary of the lake to the nearest part of

" the South Sea coast, the distance does not
" exceed ten or twelve leagues, through a
" level country. It is true, indeed, the entrance
" into the river, from the harbour of St. John's,
" is somewhat obstructed by a bar, on which
" there are only five feet of water. The har-
" bour called St. John's, is very capable of
" containing from ten to fifteen ships of war,
" with shallow water-births, of about three
" fathoms; and there is room enough for about
" one hundred sail of transports besides, which
" will be perfectly secure from the north and
" south winds, the only dangerous winds on
" the coast.

" The finest harbour on all the continent,
" from Honduras to Portobello, is undoubtedly
" the Bocco del Torro; a place not only capa-
" ble of containing the whole navy of Great
" Britain, with good anchorage throughout,
" but which has within it many excellent har-
" bours, sheltered from the wind at every point
" of the compass. It commands a tract of coun-
" try one hundred miles in extent, and joins a
" lagoon, called the Cherique Lagoon. The
" rivers that empty themselves into this lagoon,
" are, indeed, little known to any people ex-
" cept our Mosquito Indians, who say they
" have traced some of them quite back to the
" Spanish settlements. They aver that there is a

84901

" lagoon on the South Sea coast, right oppo-
" site to the Cherique Lagoon, and that these
" lagoons have a communication with each
" other, by means of some of the rivers above-
" mentioned. Certain it is, that from a hill on
" the interior banks of the Cherique Lagoon,
" there is a spacious prospect of both seas.
" The navigation into the harbour we are now
" speaking of, will be attended with no kind
" of difficulty to ships of the largest tonnage,
" the smallest depth being five fathom."

Humboldt thus writes; " The great lake of
" Nicaragua, situated in the province of that
" name, communicates not only with the lake
" of Leon, but also on the east, by the river of
" San Juan, with the sea of the Antilles. The
" communication with the Pacific Ocean, would
" be effected in cutting a canal across the
" Isthmus, which separates the lake (of Nica-
" ragua) from the gulf of Papagayo; on this
" strait Isthmus are to be found the volcanic
" and isolated summits of Bombacho, at
" 11° 7′ of latitude; of Grenada, and of the
" Papagayo at 10° 50′ of latitude. The old
" maps point out a communication by water
" as existing across the Isthmus from the lake
" to the great ocean. Other maps, somewhat
" newer, represent a river under the name
" of Rio Partido, which gives one of its

" branches to the Pacific Ocean, and the other " to the lake of Nicaragua; but this divided " stream does not appear on the last maps pub- " lished by the Spaniards and English."

" There are, in the archives of Madrid, " several French* and English memoirs on the " possibility of the junction of the lake of Nica- " ragua with the Pacific Ocean. The commerce " carried on by the English on the coast of " Musquito, has greatly contributed to give " celebrity to this project of communication " between the two seas. In none of the me- " moirs which have come to my knowledge, is " the principal point, the height of the ground " in the Isthmus, sufficiently cleared up.

" From the kingdom of New Grenada to the " environs of the capital of Mexico, there is " not a single mountain, a single level, a single " city, of which we know the elevation above " the level of the sea. Does there exist an " uninterrupted chain of mountains in the pro- " vinces of Veragua and Nicaragua? Has this " Cordillera, which is supposed to unite the " Andes of Peru to the mountains of Mexico, " its central chain to the west or the east of the

* " Mémoire sur la Passage de la mer Sud à la mer du Nord, par " M. la Bastide, en 1791.—Voyage de Marchand, vol. i p. 565.— " Mapa del Golfo de Mexico, por Thomas Lopez y Juan de la " Cruz. 1755."

" lake of Nicaragua? Would not the Isthmus
" of Papagayo rather present a hilly tract, than
" a continued Cordillera? These are problems,
" whose solution is equally interesting to the
" statesman and the geographical naturalist.

" There is no spot on the globe so full of
" volcanoes as this part of America, from the
" 11° to the 13° of latitude; but do not these
" conical summits form groups, which, sepa-
" rately from one another, rise from the plain
" itself? Perhaps the communication of the
" lake of Nicaragua with the Pacific Ocean,
" could be carried on by the lake of Leon, by
" means of the river Tosta, which, on the road
" from Leon to Rea Lexa, descends from the
" volcan of Telica. In fact, the ground
" appears there very little elevated. The
" account of the voyage of Dampier leads us
" even to suppose, that there exists no chain
" of mountains between the lake of Nicaragua
" and the South Sea. 'The coast of Nicoya,'
" says this great navigator, 'is low, and covered
" at full tide. To arrive from Ria Lexa to
" Leon, we must go twenty miles across a
" country, flat and covered with mangle
" trees.' The city of Leon itself is situated in
" a savanna. There is a small river, which,
" passing near Rea Lexo, might facilitate the
" communication between the latter port and

" that of Leon.* From the west bank of the " lake of Nicaragua, there are only four marine " leagues to the bottom of the gulf of Papa- " gayo, and seven to that of Nicoya, which " navigators call la Caldera. Dampier says " expressly, that the ground between la Cal- " dera and the lake is a little hilly, but, for the " greatest part, level and like a savanna "

The Edinburgh Review, No. XXVI. for January 1809, in noticing the natural facilities of this Isthmus, refers to some important literary information on this subject :—

" Further north, is the grand lake of Nica- " raguay, which, by itself, almost extends he " navigation from sea to sea. Into the Atlantic " Ocean it falls by a navigable river, and reaches " to within three leagues of the Gulf of Papa- " gayo in the Pacific.† Mr. Jefferys tells us, it " was the instruction of the King of Spain to " the Governor of St. John's Castle, not to per-

* " Collection of Dampier's and Wafer's Voyages, vol. 1, pp. 113, 119, 218."

On comparing these passages with Dampier, it is evident they are not quotations, but a summary of the supposed purport of his descriptions.

† " The reader may consult, on the facility and importance of " effecting a navigation from sea to sea by this extraordinary lake, " a curious memoir by M. Martin de la Bastide, ancien secrétaire, " de M. le Comte de Broglio, published in the second volume of " l'Histoire Abrégée de la Mer du Sud, par M. de Laborde."

"mit any British subject to pass either up or "down this lake."

On this route, Robinson thus expresses himself: "We now come to treat of a section of "the American continent, where the magnifi- "cent scheme of cutting a navigable canal "between the two oceans appears unincum- "bered with any natural obstacles.

"The province of Costa Rica, or, as it is "named by some geographers, Nicaragua, has "occupied but the very cursory notice of either "Spanish or other writers; they have all, how- "ever, stated, that a communication could be "opened by the lake of Nicaragua between "the two seas; but no accurate description of "the country has ever been published. In "looking over the excellent maps of Mellish "and Doctor Robinson, recently published, we "perceive that the river called San Juan dis- "charges its waters into the Atlantic Ocean, in "the province of Costa Rica, about the lati- "tude of 10° 45′ north. This noble river has "its source in the lake of Nicaragua. The "bar at its mouth has been generally described "as not having more than *twelve feet* water on "it. About sixteen years ago, an enterprising "Englishman, who casually visited the river, "examined the different passages over the bar,

" and discovered one, which, although narrow,
" would admit a vessel drawing *twenty-five feet.*
" It is said, that some of the traders to that
" coast from Honduras are likewise acquainted
" with the passage just mentioned, but it has
" never been laid down on any map; and if the
" Spanish government had been informed of it,
" they would, conformably to their usual policy,
" have studiously concealed it. After the bar
" of the San Juan is crossed, there is excellent
" and safe anchorage in four and six fathoms
" of water. It is stated that there are no ob-
" structions to the navigation of the river, but
" what may be easily removed, and at present
" large brigs and schooners sail up the river
" into the lake. This important fact has been
" communicated to us by several traders. The
" waters of the lake throughout its whole extent,
" are from three to eight fathoms in depth.

" In the lake are some beautiful islands,
" which, with the country around its borders,
" form a romantic and most enchanting scenery.
" At its western extremity is a small river,
" which communicates with the lake of Leon,
" distant about eight leagues. From the latter,
" as well as from Nicaragua, there are some
" small rivers which flow into the Pacific Ocean.
" The distance from the lake of Leon to the
" ocean is about thirteen miles; and from Nica-

" ragua to the gulf of Papagayo, in the Pacific
" ocean, is twenty-one miles. The ground be-
" tween the two lakes and the sea is a dead le-
" vel: the only inequalities seen are some iso-
" lated conical hills, of volcanic origin. There
" are two places where a canal could be cut with
" the greatest facility; the one, from the coast
" of Nicoya (or, as it is called in some of the
" maps, Caldera) to the lake of Leon, a distance
" of thirteen or fifteen miles; the other, from the
" gulf of Papagayo to the lake of Nicaragua,
" a distance of about twenty-one or twenty-
" five miles. The coast of Nicoya and the
" gulf of Papagayo are free from rocks and
" shoals, particularly in the gulf, the shore of
" which is so bold, that a frigate may anchor
" within a few yards of the beach.

" The climate of Costa Rica has none of
" the deleterious qualities of the province of
" Choco and the Isthmus of Panama. The sea-
" breezes from the Pacific, as well as from the
" Atlantic, set in steadily every morning, and
" diffuse over the whole Isthmus of Costa Rica
" a perpetual freshness. We think it is not
" hazarding too much to say, that this part of
" the American continent is the most salu-
" brious of all the tropical regions. The most
" finely-formed and robust race of Indians of
" the American continent are found here. The

" soil is peculiarly fertile, particularly in the
" vicinity of the river San Juan, and around
" the borders of the lakes Nicaragua and
" Leon.

" From the preceding outline, it will be per-
" ceived that nature has already provided a
" water conveyance through this Isthmus to
" within a few leagues of the Pacific Ocean.
" But, supposing that the route we have men-
" tioned, up the river San Juan, and through
" the lake of Nicaragua, should, when accu-
" rately surveyed, discover obstructions (which
" we do not anticipate) to the navigation of
" large vessels, where would exist the difficulty,
" in such case, of cutting a canal through
" the entire Isthmus? The whole distance is
" only one hundred and ninety, or at most two
" hundred miles, from the Atlantic Ocean to
" the gulf of Papagayo. There is scarcely ten
" miles of the distance but what passes over a
" plain; and, by digging the canal near the
" banks of the river San Juan, and the margin
" of the lake of Nicaragua, an abundant supply
" of water could be procured for a canal of any
" depth or width. Surely the magnitude of
" such an undertaking would not be a material
" objection in the present age of enterprise and
" improvement. It may be said, that the pre-
" sent poverty of the country, and its thin

"population, are powerful obstacles to the "execution of the project. If Costa Rica were "in possession of a liberal government,* wil- "ling to lend its encouragement to this impor- "tant object, capital in abundance would "speedily be forthcoming, either from Great "Britain or from the United States. Enter- "prising companies would soon be formed; "and we hazard little in predicting, that the "canal stock of such an association would yield "a profit far greater than that of any other "company in the world. With regard to the "difficulty of procuring labourers in the pre- "sent state of the population of the country, it "would soon be obviated. The Indians of "Guatimala and Yucatan would flock to the "Isthmus of Costa Rica in thousands, provided "the banners of freedom were hoisted there, "under any government capable of affording "them protection, and rewarding them for their "labour. Unfold to these unfortunate beings "a new and rational mode of existence; offer "them moderate wages and comfortable cloth-

* Robinson's work, from which the above extracts are taken, was published in 1821, before the present government of the Central Provinces of America (which include Nicaragua), was instituted. The decree recently made by that government, to encourage foreign settlers on its territories, is a proof of its liberality, and a judicious measure of internal policy for the improvement of an infant State.

"ing; give them personal protection, and allow "them the advantages of a free external and "internal commerce, and they would soon dis- "play a different character. Offer to the view "of the Indians these blessings, and multitudes "would repair to the proposed point from "all the adjacent countries. Under such cir- "cumstances, we do not entertain any doubt "that twenty, thirty, or even fifty thousand In- "dians could be procured for the work in ques- "tion, who would give their labour with grati- "tude for a moderate compensation.

"We feel great pleasure in stating, that "many of these ideas are derived from an in- "teresting and able Memoir, written by the late "Bryan Edwards, the celebrated historian of "the West-Indies. We perused it, several "years since, at Jamaica, and although we have "not seen it among any of the published works "of that distinguished writer, we believe the "Memoir to have been laid before the British "government. Bryan Edwards was perfectly "aware of the importance of Costa Rica to the "British nation, and of the practicability of "forming a communication between the two "seas in the manner we have suggested. We "presume the British government have not lost "sight of those representations, nor of other "interesting communications on the same sub-

" ject, which have been made to them by several
" intelligent individuals who had resided in the
" bay of Honduras.

" Should a canal be cut through Costa Rica,
" of sufficient dimensions to admit the passage
" of the largest vessels, and ports of free com-
" merce to all nations be established at the
" mouths of this canal, on the Pacific and Atlan-
" tic Oceans, there cannot be a doubt that this
" Isthmus would become the greatest commer-
" cial thoroughfare in the world. Let the
" reader cast his eye on the map, and behold its
" important geographical position. Nearly
" central as respects the distance between Cape
" Horn and the north-west coast of America,—
" in the vicinity of the two great oceans, super-
" seding the necessity of the circuitous and peril-
" ous navigation round Cape Horn; it appears
" to be the favoured spot, destined by nature
" to be the heart of the commerce of the
" world.

" The most ardent imagination would fail
" in an attempt to pourtray all the important
" and beneficial consequences that would result
" from the execution of this work, the magni-
" tude and grandeur of which are worthy the
" profound attention of every commercial na-
" tion. It is a subject so deeply and generally
" interesting, that the powerful nations of the

" Old and those of the New World, should dis-
" card from its examination all selfish or am-
" bitious considerations. Should the work be
" undertaken, let it be executed on a magnifi-
" cent scale; and, when completed, let it be-
" come, like the ocean, a highway of nations,
" the enjoyment of which shall be guaranteed
" by them all, and which shall be exempt from
" the caprice or regulations of any one king-
" dom or state. This idea may, at first view,
" appear as extravagant as it is novel, but we
" cannot perceive any thing in it that is not
" in unison with the liberal and enterprizing
" spirit of the present age; and we feel perfect-
" ly assured, that if it receives the encourage-
" ment and support of the nations of the Old
" World, those who will hereafter govern in the
" New, will not hesitate to relinquish a few
" leagues of territory on the American conti-
" nent for the general benefit of mankind; and
" more especially when America herself must
" derive permanent and incalculable advan-
" tages, from being the channel of communica-
tion between the Oriental and the Western
" World."

REMARKS ON THE TOPOGRAPHY OF THE ISTHMUS OF NICARAGUA.

The great question, whether it is practicable to open a navigation for sea-going ships across the Isthmus of America, being apparently narrowed by the physical obstacles of the routes that have been already considered, to the inquiry whether that important project can be effected at the minor Isthmus of Nicaragua, or at that of Darien, properly so called, or possibly at Tehuantepec, immense interests are concentrated in this division of the subject, because at Darien a formidable, though not perhaps an invincible obstacle, must be encountered.

Until a scientific survey of all the routes that diverge from lake Nicaragua shall have ascertained leading facts and main points with precision, all reasoning upon this head of the subject must be inconclusive, because the information that is extant upon it is limited, and, on several points, contradictory. Robinson very justly observes, that the province of Nicaragua has attracted but little notice, yet there we have the greatest power of improvement. There is one certainty to encourage us; that is, the space of land to be intersected between lake Nicaragua and the

South Sea is narrow; and it is a further encouragement, that there may be an option of several routes across that space of land: one to the gulf of Papagayo, another to the gulf of Nicoya, and the third to lake Leon, and through it, or with the aid of its waters, to the port of Ria Lexa.

The practicability of intersecting the Isthmus at one of these routes being highly probable, and being the main question to be solved, the consideration of it may be directly proceeded with, by assuming, for the present, that the lake of Nicaragua itself, and the main branch of its river, called the San Juan, which flows into the North Sea, are, or can be made, navigable for ships.

Such, however, is the contrariety of report on the character of the river San Juan, that it should be the first topic for consideration, whether its defects are of a nature to preclude and dispense with the proposed discussion upon the routes between lake Nicaragua and the South Sea. But as it will be shown, that it may be within the reach of hydraulic achievement to obviate the defects of the San Juan, or to construct an adequate substitute if they are incurable, the discussion may commence with those routes.

The breadth of this Isthmus between lake Nicaragua and the gulf of Papagayo, is stated

by Humboldt to be four leagues; and by M. Martin de la Bastide, who is quoted by the Edinburgh Review, to be three leagues. Robinson states the distance to be twenty-one miles, and afterwards vaguely calls it twenty-one or twenty-five miles; but his estimates appear to have resulted from inadvertency, of which there are other instances among his remarks upon the Isthmus of Nicaragua. He says, for example, "In the gulf of Papagayo, "the shore is so bold that a frigate may anchor "within a few yards of the beach;" and omits every other circumstance, as if deep water is the only requisite for the termination of a canal that is to conduct a ship into or from the seas; and he also states, "that the ground between "the two lakes and the sea is a dead level; "the only inequalities seen are some isolated "conical hills, of volcanic origin." But the specific description of the gulf and coast of Papagayo extant in the narrative of William Funnel, which has been already quoted, tells us, in effect, that the gulf of Papagayo does not contain any suitable port, or any shelter, landing-place, or other available requisites for the construction of an artificial harbour. It also implies, that the interior of the land which bounds the middle of the gulf, and the shores of the western side of the gulf, is higher than the land by the sea-

side, at the middle, and at part of the east side of the gulf.

The context of the description alluded to, shows, that at the river Atelas, which is five leagues to the south-east from the point of St. Catherine, the eastern limit of the gulf of Papagayo, "the land begins to be moun-" tainous;" that, "Mount Hermosa grows " higher and higher within land;" and that many sands, shoals, and rocks stretch out from several parts of this last-mentioned coast for a mile, and at one place to near three leagues into the sea; that "the coast continues moun-" tainous, and very bad and rocky, and without " a port, from mount Hermosa to cape Gajones, " between which cape and cape Blanco is " a small bay, called the bay of Caldera;" that "right over the bay is a plain even land, " called the Table of Macotela," and that, " From cape Blanco to the Herrardura is nine " leagues, between which is the gulf of Nicoya: " it is a place much used by the Spaniards." From which it appears that, excepting five leagues of the coast, from the gulf of Papagayo to the gulf of Nicoya, it is a mountainous country with a foul shore, and therefore cannot be "a dead level."

Humboldt observes, "Dampier leads us even " to suppose, that there exists no chain of moun-

" tains between the lake of Nicaragua and the " South Sea!" But the absence of a *chain* of mountains does not controvert the inferences that are above drawn from the words of Funnel. Be it observed, however, that Dampier has not given any description of the land between that lake and sea, except at the bay of Caldera and the gulf of Nicoya; all the rest of that coast, from the port of Ria Lexa to the bay of Caldera, which space comprehends the gulf of Papagayo, and extends about sixty-five leagues, Dampier has not described.

These facts and obvious inferences warrant a reasonable belief, until it shall be removed by better information, that the utter want of a proper sea-board, and probably the nature of the surface of the country, would render the intersection of the Isthmus between lake Nicaragua and the gulf of Papagayo, by a ship-canal, inexpedient, and useless even if it could be effected.

"The route that comes next under consideration in this Isthmus is that which lies between lake Nicaragua and the gulf of Nicoya. Humboldt says: " From the east bank of the lake " of Nicaragua, there are seven marine leagues " to the gulf of Nicoya, which navigators call la " Caldera;" and adds, " Dampier says express- " ly, that the ground between la Caldera and the

" lake is a little hilly, but for the greater part " level and like a savanna." But these passages appear to be misconceptions of the words of Dampier, which have been quoted in the preceding section, and clearly show that the gulf of Nicoya and the bay of Caldera are not the same, as supposed by Humboldt and Robinson; Caldera being a small bay outside of the gulf, for it lies to the north-west of cape Blanco, which is the western extremity of the gulf of Nicoya. Nor, do Dampier's words warrant the above interpretation as to the nature of the ground between the bay of Caldera and the lake, for after stating, that " about a mile " from a certain brook" (which at the entrance of the bay runs into the sea), " towards " the north-east, the woodland terminates;" he adds these words, " here the savanna land " begins, and runs some leagues into the " country, making many small hills and dales." These words show, that savanna does not mean level land, but land for the most part clear of trees; and, it is to be understood, producing grass. Here, it should be observed, that the words, " towards the north-east" from the bay of Caldera, very nearly describe the bearing of the land that lies between lake Nicaragua and the inner part of the gulf of Nicoya; the character of which intermediate

tract, is put beyond all doubt by the next passage in Dampier: "further in the country "the land is high and mountainous; the moun- "tains are part woodland, part savanna. "From the bottom of this bay it is but fourteen "or fifteen leagues, to the lake of Nicaragua "on the North Sea coast; the way between is "somewhat mountainous, but most savanna." These expressions of Dampier, though somewhat qualified at the conclusion, describe a country of a more mountainous character than "a little hilly, but for the greatest part level," and very different from "a dead level" country, which Robinson has been led to suppose, lies between both the lakes and the South Sea.

A few facts and circumstances which are noticed by Dampier, indicate that the Isthmus between the inner part of the gulf of Nicoya and lake Nicaragua, may not be quite so favourable for a ship canal, as speculative and enthusiastic writers have supposed.

Dampier says: "Nicoya is a small mulatto "town, about twelve or fourteen leagues east "from hence (bay of Caldera), standing on the "bank of a river of that name. It is a place "very fit for building ships, therefore most of "the inhabitants are carpenters. By the sea- "side, in some places, there grew some red "wood, useful in dyeing; of this they (two

" Spanish Indians) said there was little profit made, because they were forced to send it " to the lake of Nicaragua, which runs into " the North Sea. That they sent thither, also, " great quantities of hull and cow-hides, and " brought from thence, in exchange, Europe " commodities." Funnel states: " In this gulf " (Nicoya) are the island of St. Lucas, and the " island of Chira: to this latter island the Spa- " nish ships come to take in their lading, which " is brought from Nicoya, distant about ten " leagues." To which he adds, " Observe, " when you enter into this gulf, that you leave " all the islands to the westward, except the " island Guabiabas. From the Middle Islands " to the island of Chira is clear ground, and six " or seven fathom water. When you sail up " the gulf, you must sail nearer the islands than " the main land, because near the main are " several shoals, which stretch a considerable " way."

From these facts and circumstances, several important inferences may be drawn. First, that there is a route for the land-carriage of heavy and bulky goods, and, therefore, not very mountainous, across the Isthmus, from the town of Nicoya to Lake Nicaragua. Second, that the country between the inner part of the gulf and the lake, where it is narrowest, con-

tains some obstacle or difficulty which makes it unfit for the carriage of goods, and compels the trade to pass through the town of Nicoya; which is not so direct and short a transit, particularly from the island of Chira, which lies near the middle part of the gulf. Third, that the river of Nicoya, though ships are built there, will not admit laden vessels, which, for that reason, and the want of shelter nearer to Nicoya, are obliged to anchor ten leagues off, at the island of Chira; and, that the river may not have its source in Lake Nicaragua. Fourth, that the shores of the gulf of Nicoya are shoal in several places; and, probably almost all round, from Cape Blanco to Cape Herrardura.

The *first* inference is sustained by the fact of a traffic being carried on from the town of Nicoya to the lake of Nicaragua. The *second* is deducible from the circumstance of that traffic being carried on by a much longer route, commencing at the town of Nicoya, which is ten leagues from the anchorage at the island of Chira, and not by the direct one from that island to the shore of the inner part of the gulf, and from thence to Lake Nicaragua. The *third* is self-evident, from the fact that the Spanish ships have been obliged to lie at the island of Chira, subject to the inconvenience and expense of conveying their cargoes ten leagues in boats,

to and from the town of Nicoya. And the *fourth* is as much a matter of fact as of inference, from the sailing instructions given by Funnel. Thus, if Robinson means the shore of the gulf, in saying, that "the coast of Nicoya is free "from rocks and shoals," there is express authority for controverting the assertion.

There is some presumptive evidence, through the above inferences, that the inner part of the gulf of Nicoya, and the adjacent country, may not be quite an eligible route for a ship-canal. However, that unfavourable presumption is countervailed by the fact that several rivers enter the gulf of Nicoya, at places which indicate that their sources are near Lake Nicaragua. For example, the river of Despenza del Rey and Tempesque river, among others, of which Funnel says, "here are a great many." In the river de la Despenza, he adds, "ships "are built;" and that "in the river Tem- "pesque we took two barks." These rivers, though of inadequate depth for laden ships, certainly would indicate that there may be continuous levels for the passage of water in the direction of the lake of Nicaragua; but, if they do not flow from the lake, they show that there is high intermediate ground.

There is, however, some probability that one of these rivers, even though it may be

interrupted by small falls, shallows, or rapids, might be made an eligible route for a ship-canal with locks. The gulf itself affords, according to Dampier and Funnel, ample shelter and several good anchorages for ships in deep water at the Middle Islands, the island of St. Lucas, and the island of Chira; and there can scarcely be a doubt, but that a good artificial harbour might be constructed at a suitable part of the shore of the gulf of Nicoya, to terminate a ship-canal; for which it appears, from many concurring probabilities, the Isthmus between that gulf and Lake Nicaragua may afford a suitable route.

The third line of communication projected between Lake Nicaragua and the South Sea comes next under consideration. It is through Lake Leon to the port of Ria Lexa. Commencing at the north-western extremity of Lake Nicaragua, it should proceed in the bed or valley of the small river, by which, according to Robinson and all extant maps, the two lakes communicate with each other through a space of about eight leagues. The intermediate country has not been described, nor is it stated in which direction this small river flows, or whether it is free from falls, shallows, and rapids; consequently, we are ignorant of the relative heights of the waters of each lake. We are also with-

out any information as to the average depth of Lake Leon; but it is probably shallow, if the small river alluded to be either its principal source of supply, or its principal vent; because lakes in general, being only the expanded beds of rivers, their depths are often proportioned to their supplies and discharges, unless they occupy natural basins; which, however, in volcanic countries, like the Isthmus, are often of great depth. Even the length of Lake Nicaragua, and of Lake Leon, is imperfectly known to us; our information being derived merely from geographical proportion, and not from actual survey.

In considering the foregoing authorities on the nature of the ground between Lake Leon and Ria Lexa, our attention is arrested by the following passage in Humboldt, who gives it as a result of Dampier's descriptions, although in the shape of a quotation: "To arrive from "Ria Lexa to Leon, we must go twenty miles "across a country, flat and covered with man-"gle trees." When it is remembered that mangle or mangrove trees, are only produced in a sea-water-marsh, or swamp, the inference which naturally follows the sentence above quoted is, that the whole country, between Ria Lexa and Leon, is of that character; the cutting through of which would be next to impossible, as the pestilential diseases, incidental to

such a soil and operation, in a tropical climate, would be fatal to Europeans. This inference, if sustained, would constitute an argument against the facility of cutting a canal between Leon and Ria Lexa.

It is, therefore, an indispensable duty to observe, that on diligent research through the writings of Dampier, the precise words, as quoted by Humboldt, have not been found, and that the following passages, which occur in his works, indicate that nearly the whole of that distance is dry, sandy, and firm land. After describing the port of Ria Lexa, and the creek that leads towards Leon, which, he says, "is "very narrow; the land on both sides lying so "low, that every tide it is overflown with the "sea, and produceth red mangrove trees, so "plentiful and thick there is no passing through "them;"—he adds, "beyond these mangroves "on the firm land, close by the side of the "river, the Spaniards have built a breastwork, "to hinder an enemy from landing;" and then says, "the city of Leon is twenty miles up in "the country; the way to it plain and even, "through a champion land of long grassy "savannas, and spots of high woods. About "five miles from the landing-place there is a "sugar-work; three miles farther there is ano-"ther; and two miles beyond that, there is a

"fine river to ford, which is not very deep; "besides which there is no water in all the way, "until you come to an Indian town, which is "two miles before you come to the city; and "from thence it is a pleasant straight sandy "way to Leon. The city stands in a plain not "far from a high-peaked mountain, called the "Volcan of Leon. The country about it is of "a sandy soil, which soon drinks up all the rain "that falls, to which these parts are much sub-"ject. It is encompassed with savannas."

The relative proportion which either the mangrove land or the firm dry soil forms, of the computed distance of twenty miles, does not appear from the above description. But it is evident the firm dry land so greatly predominates, that we are justified in assuming, both from that and from another description, also given by Dampier, of a neighbouring creek which leads from the port to the town of Ria Lexa, that the mangrove land, probably does not extend much more than two miles in the direction of Leon, and, for that comparatively short distance, the mangroves are intersected by a navigable creek or river.

In noticing the above slight inaccuracy, as well as a few others which appear in the writings of M. Humboldt on this subject, every painful feeling is mitigated by the consciousness

that he stands too high in the grateful estimation of the world, to be either offended or disparaged, by the respectful notice of such mere inadvertencies. He who has successfully explored the sources of human improvement, and quarried into the remote and hidden recesses of nature, discovering by the lights of science new beauties and facilities, which attest the power of the Creator and his beneficence to man, may well permit an admiring reader to point out a few casual mistakes in his important and luminous work.

That eminent statistical writer appears to be well warranted in respect of so much of this route, as lies between the city of Leon and the South Sea, in expressing his opinion, that "in "fact the ground there appears very little "elevated;" and perhaps he may be right in assuming, that, in the direction of Lake Leon, "Dampier leads us even to suppose, that there "exists no chain of mountains between Lake "Nicaragua and the South Sea." It has been already shown that this supposition may not be fully applicable to the coast at Caldera, which Dampier has described; and it should be observed, that he did not travel through, and has not expressly mentioned, the part of this route which lies between the city and the lake of Leon, or that which lies between Lake Leon and Lake

Nicaragua. Those two spaces are at the opposite extremities of Lake Leon, and therefore the latter was not within the view of Dampier, when he was at the city of Leon; but as the former might have been then fully before him, it may be supposed that the space, between the city and the lake of Leon, is of the same general character as the country in the vicinity of the city, which "is very little "elevated:" because he does not mention any elevated land except the high-peaked mountain. True it is, that Dampier does not notice the small river which the maps represent as flowing between the two lakes, nor does he even specify Lake Leon itself. But, as it is apparently established by common consent in modern times, that there is such an intermediate river, the existence of it corroborates the general inference or supposition drawn by Humboldt from the words of Dampier though they are not expressly applicable to that part of this route.

Upon another fact there is a discordance between the statement of Humboldt and the description given by Dampier. Humboldt says, "the port of Ria Lexa in Guatimala is formed, "like Guayaquil, by a large and beautiful "river." Dampier says, "The creek that "leads to Ria Lexa, lieth from the N. W. part

" of the harbour, and it runs in northerly. It is " about two leagues from the island in the har- " bour's mouth to the town: two-thirds of the " way it is broad; then you enter a narrow deep " creek, bordered on both sides with red man- " grove trees, whose limbs reach almost from " one side to the other. A mile from the mouth " of the creek it turns away west; there the " Spaniards have made a very strong breast- " work. Here we landed, and marched to the " town of Ria Lexa, or Rea Lejo, which is about " a mile from hence. This town stands on a " plain *by a small river.*"

There is also a difference between the observations of Humboldt and those of Robinson, upon the route between Lake Leon and the South Sea. Humboldt supposes, that the communication with that sea could be carried on by means of the river Tosta, which, on the road from Leon to Ria Lexa, descends from the volcano of Telica; and, subsequently observes that "There is a small river, which, pass- " ing near Rea Lexo, might facilitate the com- " munication between the latter port and that of " Leon.*" Robinson states, that from both lakes there are small rivers which flow into the Pacific Ocean. Now, Humboldt evidently proposed to

* This is certainly a mistake. The port of Ria Lexa itself is the port of Leon. See pages 95 and 97.

call in the aid of these neighbouring rivers, for want of any such direct outlets from Lake Leon, as those, which Robinson says, flow from it to the ocean. But Humboldt appears to be mistaken in the character of the river Tosta; and Robinson equally so, in supposing that, even if there are direct outlets from Lake Leon, they could be converted to the purposes of navigation: for William Funnel, before quoted, says, "from the port of Ria Lexa to the river de "Tosta is three leagues: this river is sometimes "dry, but if it were not, yet the sea runs so "high, and falls with such force upon the shore, "that there is no landing near it." He then adds, in substance, that from the river de Tosta, eighteen leagues E. S. E. as far as Mount Martiare (the western extremity of the gulf of Papagayo), it is a very windy and hard coast, on which falls a great sea, and no port near it; and he specifies six leagues of that coast as being high land, besides the mountains of Sutaba, the volcano of Telica, and the volcano of Leon.

Hence it appears that the river Tosta being sometimes dry, cannot be of any material use for any purpose; and that if there are other small rivers on this coast, even if they flow from Lake Leon, they are not capable of being made navigable by ships to the ocean, because this coast, like that of the gulf of Papagayo, does

not admit of such a communication with the sea.

There are some other inaccuracies in Robinson, chiefly in respect of distances, which it is needless to specify, as they have probably arisen from accident or oversight. He appears to have inadvertently named or applied his remarks to one of the lakes, when he evidently intended to mention the other; and he seems to have applied to the external boundaries of both lakes, the local character of a part of the boundary of one lake. In this way it is possible to account for his saying, that "the ground between the two lakes and the sea is a dead "level," although that description is only applicable, and in a qualified sense, to the road between Ria Lexa and the city of Leon; and that, "from the coast of Nicoya (or, as it is "called in some of the maps, Caldera) to the "lake of Leon, is a distance of thirteen or fifteen miles," though that distance is probably about one hundred and fifty miles.

It results from this consideration of the three projected routes from Lake Nicaragua to the Pacific Ocean, that there is presumptive evidence that two of them may be practicable routes; one from Lake Nicaragua to the gulf of Nicoya, and the other from that lake to Lake Leon, and from thence to the port of Ria Lexa.

The distance, in either case, could not be very long, and would be far preferable to the plan hypothetically put by Robinson, of cutting a canal through the entire Isthmus, from the Atlantic side to the gulf of Papagayo, which he computes to be at most two hundred miles. The objections to a ship canal of great length, which have been adduced in respect of Panama and Tehuantepec, apply, with almost equal force, to such a canal across the entire Isthmus of Nicaragua, where it would not be wanted, if the river San Juan is as navigable as he represents; as in that case, a ship canal, of a very few miles in length, would probably be sufficient at any one place to obviate each of the apprehended impediments at Nicaragua. Each such canal could be passed in a very few hours of a single day, and therefore ships would be proportionably less subject to interruption or misfortune.

Having proceeded thus far in considering the slender information that is extant relative to the topography of this Isthmus, upon the assumption and supposition that the Lake Nicaragua, and the branch of its river, called the San Juan, by which the waters of the lake are discharged into the North Sea, are navigable to the degree stated by Robinson, and capable of being made adequate to the passage of merchant ships of large tonnage, it is now become necessary to

examine the grounds of that assumption and supposition.

There is extreme inconsistency of report on the possibility of navigating the river San Juan. Robinson says, "It is stated that there are no "obstructions to the navigation of the river "but what may be easily removed; and at "present large brigs and schooners sail up the "river into the lake." Bryan Edwards says, "I have been assured, if I am not greatly de-"ceived in my recollection, that a vessel of "thirty tons has sailed up to the entrance of "this lake. The chart of the West-Indies, published in 1820, by Norrie of London, specifies that there are cataracts in this river, which some recent maps of Nicaragua denominate three falls. It is true these cataracts or falls may be only partial shallows, which, during floods, become rapids; yet still they are not at all reconcilable with Robinson's description, and scarcely with that of Bryan Edwards. Therefore, the real state of the channel and navigation of the river is unknown; and it is almost useless to reason upon it, until an authentic survey shall have been made. If, however, such cataracts or rapids do exist, they may certainly be obviated by a collateral ship canal, with locks, for the summit level of which there is, no doubt, an ample supply of water.

An advantage may even attend such cataracts or falls, as the consequent elevation of the waters of Lake Nicaragua, would give them a similar command of the summit level of the other canal, which it appears necessary should be made from that lake to the gulf of Nicoya, or to Lake Leon and Ria Lexa.

On the certainty of Robinson's information relative to the depth and navigable character of Lake Nicaragua, it is impossible to pronounce until a survey shall have been made of the lake for the purpose in view. But there is good reason to presume, from the richness and depth of the soil of its shores and islands, that a spacious channel of adequate depth and breadth, might be easily formed in the proper direction, by the powerful means of floating steam dredges, such as are used in deepening the beds of rivers, and for excavating the foundations of bridges in Great Britain. Some of these machines raise at the rate of near five thousand tons of mud or sand in twenty-four hours, and in the still waters of a lake might work incessantly. By the same efficacious means, it is probable that Lake Leon might be equally improved, if requisite; but until the relative elevation of the waters of both lakes, and other circumstances, shall be accurately known, it is needless to say

more relative to the improvement of Lake Leon. There might not be any necessity for carrying the proposed navigation through this lake, even for the purpose of enabling ships to pass from Lake Nicaragua to the port of Ria Lexa, as it might be more convenient to use its waters in supplying a canal, or in reinforcing the waters of Lake Nicaragua, by deepening the small river of eight leagues in length, which flows between the two lakes, in the event of that river being found to flow from Lake Leon to Lake Nicaragua.

Such being the apparently improvable character of the course within land of the river San Juan, and of the lake of Nicaragua, the inquiry, thus far, inspires cheering hopes of the effectual attainment of this great object; but there is a bar at the mouth of that river, the nature of which is not yet sufficiently known.

The reports relative to this bar are utterly at variance with each other. Robinson says, "This noble river has its source in the lake of "Nicaragua. The bar at its mouth has been "generally described as not having more than "*twelve feet* water on it. About sixteen years "ago an enterprising Englishman, who ca-"sually visited the river, examined the different "passages over the bar, and discovered one,

"which although narrow, would admit a vessel "drawing *twenty-five feet;* but it has never "been laid down on any map."

Bryan Edwards says, "It is true, indeed, the "entrance into the river, from the harbour of "St. John's, is somewhat obstructed by a bar "on which there are only *five feet* of water."

These contradictory reports would lead to the belief that twelve feet (the depth assigned to the water on this bar by Dampier) may be nearly right, as that is about the average depth on the bars of other large rivers on this coast of the American Isthmus.

But it is probable that this river acquires, like the Guasacualco, a temporary increase of depth on its bar, from the force of floods during the rainy seasons; as the bars of both rivers seem to be produced by the same natural causes, namely, the current of rotation,* or gulf-stream, or its eddy, and the want of adequate tides. If this is the case, it may not be unlikely that at such a time the discovery was made of the passage over the bar, said to be capable of admitting ships drawing twenty-five feet water, and that passage having been temporary, may be the reason it has not been laid down on any map. Such occasional increase of depth

* "The general motion from east to west observed in the "ocean between the tropics."—Humboldt.

would be an indication that the same additional depth might be not only obtained, but preserved, by a permanent and uniform increase of the volume of water in the San Juan.* That increase of volume might be gained by diminishing or closing the channels of the other branches of the river of Nicaragua, at the places where they separate from the San Juan, and thereby forcing an adequate portion of the waters of those branches to pass through the San Juan, and operate with united power upon its bar. In which case, care should be taken that the rapidity of the current would not be made too great for navigation.

Should it, however, be found, that a combination of bad local circumstances would prevent the permanent improvement of the bar of the river San Juan to an adequate depth, there is still an alternative which would be effectual, but the adoption of which, nothing less cogent than extreme necessity, and the immense advantages to be attained, would justify.

The great natural power which is at command in the waters of lake Nicaragua, and

† "On the Malabar coast, violent winds blow directly in upon "the shore, and they dam up the harbours, especially that of Goa, "so that no ships can come in or go out then; but, after the "violent winds are past, the channel opens again, and so continues "till the next season."—Dampier.—There are similar instances on many other coasts.

in their probable elevation, is too important and valuable a facility for improvement to allow this route to be abandoned, whilst hope remains or public spirit exists. Commensurate obstacles and greater difficulties at other routes support the suggestion of that alternative.

Bryan Edwards states, that, "The finest "harbour on all the continent, from Honduras "to Portobello, is undoubtedly the Bocco del "Torro; a place not only capable of containing "the whole navy of Great Britain, with good "anchorage throughout, but which has within "it many excellent harbours, sheltered from "the wind at every point of the compass. The "navigation into the harbour will be attended "with no kind of difficulty to ships of the "largest tonnage, the smallest depth being five "fathoms."

It is needless to pursue the hint which that writer gives of there being a route for a navigation across the Isthmus, from the Bocco del Torro to the South Sea; though there is an extraordinary coincidence in name between the Cherique lagoon, which joins that port, and the Cherique river, which Funnel assures us enters a bay that lies to the eastward of the point of Burica, in latitude 9° N., on the coast of the South Sea. It is certain that mountains occupy much of the interior of this part of the country.

The very fact mentioned by Edwards, that "from a hill on the interior banks of the "Cherique Lagoon, there is a spacious pros-"pect of both seas," is in a degree corroborative of the difficulty of intersecting the country; and a ship-canal through a mountainous tract, if it could be constructed, would be subject to all the impediments and dangers that have been specified in the foregoing sections upon the topography of Panama and Tehuantepec.

However, that nothing may be omitted which might be deemed relevant, it is right to mention, that the best port, in a corresponding direction, upon the South Sea coast, is the Golfo Dulce, "within which," Funnel says, "is a "very good harbour, and the water is very "smooth. This is accounted as good a gulf "to ride in as the gulf of Nicoya, and in it "you are secure from all winds. The water "rises and falls nine or ten foot at spring-tides. "The country is mountainous and very "woody."

The alternative above alluded to, in the event of the bar of the river San Juan being found incapable of adequate and permanent amendment, is, the construction of a ship-canal to connect the port of Bocco del Torro with the nearest branch of the river of Nicaragua, at any place, above its bar, where it would

command the summit level of such a canal. The intermediate country lies between the main ridge or body of the central mountains, and the northern sea. It is not crossed by any range of mountains, nor occupied by many, if any, hills, and is probably of a level and open character. The proposed navigation would therefore, be free from all inconveniences, except those which are incidental to any common canal.

The length of the line would certainly be very formidable, the distance being not less than about one hundred miles. But the certainty of the work being adequate to the purpose, and of having a fine port on each sea, namely, the Bocco del Toro, and the gulf of Nicoya, or the port of Ria Lexa, are powerful encouragements to the adoption of the plan, as a last resource, that the nations which expect with solicitude the execution of this great enterprise, may not be utterly disappointed.

The nature of the climate and diseases that are incidental to the provinces of Nicaragua and Costa Rica will be comprized in the general section already promised.

ON THE RELATIVE ELEVATION OF THE TWO OCEANS AT THE ISTHMUS OF AMERICA.

On this question M. De Humboldt thus reasons: "In America, the South Sea is gene-
" rally supposed to be higher at the Isthmus
" of Panama than the Atlantic Ocean. After
" a struggle of several days against the current
" of the Rio Chagre, we naturally believe the
" ascent to be greater than the descent, from
" the hills near Cruces to Panama. The idea
" of a difference of level between the Atlantic
" and the South Sea has been combated by
" Don George Juan Ulloa, who found the
" height of the column of mercury the same
" at the mouth of the Chagre and at Panama.
" The imperfection of the meteorological
" instruments then in use, and the want of
" every sort of thermometrical correction of
" the calculation of heights, might also
" give rise to doubts. These doubts have
" acquired additional force since the French
" engineers, in the expedition to Egypt, found
" the Red Sea six toises higher than the Medi-
" terranean. Till a geometrical survey be ex-
" ecuted in the Isthmus itself, we can only
" have recourse to barometrical measurements.

" Those made by me at the mouth of the Rio " Sinu in the Atlantic Sea, and on the coast " of the South Sea in Peru, prove, with every " allowance for temperature, that if there is a " difference of level between the two seas, it " cannot exceed six or seven metres.*

" When we consider the effect of the current " of rotation, which carries the waters of the " ocean from east to west, and accumulates " them towards the coast of Costa Rica and " Veragua, we are tempted to admit, contrary " to the received opinion, that the Atlantic is " a little higher than the South Sea. As the " tides rise at Portobello to a third-part of a " metre,† and at Panama to four or five metres,‡ " the level of the two neighbouring seas ought " to vary accordingly; but these trivial in- " equalities, far from obstructing hydraulical " operations, would even be favourable for " sluices."

* " Nineteen or twenty-two feet.—*Trans.*"

† " Thirteen inches."

‡ " Thirteen or sixteen feet."

REMARKS ON THE RELATIVE ELEVATION OF THE TWO OCEANS AT THE ISTHMUS OF AMERICA.

BEFORE the result of a geometrical survey of the Isthmus of America shall be known, probabilities only can be advanced upon this topic. The globe does not exhibit an exactly parallel instance. The survey of the Isthmus of Suez by the French engineers, alluded to by Humboldt, is not a case in point; because the Red Sea is not, in its geographical position, so much subject to the influence of the current of rotation as the sea of the Antilles or West-Indies; neither is it subject to a perennial trade-wind like the sea of the Antilles, and the lower or tropical latitudes of the Atlantic Ocean, but, on the contrary, it has its periodical monsoons. The narrowness of the Red Sea, especially at the Straits of Babelmandeb and at its inner extremity, does not permit the waters driven into it by one of those monsoons to escape and pass off freely, and without intermission, in the manner that the waters of the sea of the Antilles and the adjacent coast of the Isthmus continually return to the Atlantic Ocean by the gulf-stream. On the contrary,

the same monsoon that fills the Red Sea confines its waters until the periodical change of wind takes place. These differences between those two seas are manifest, from the fact of the currents at the entrance of the Red Sea being changed at particular periods, in the same order as the monsoons. "In the Red "Sea, from May till October," according to Captain Rogers, who is quoted by Dampier, "the winds are strong at south-west, and the "current setting out strong, so that there is no "entering into that sea in those months, "except you keep close to the south shore: "there you have land winds and an eddy "current. In the months of September and "October, the wind shuffles about to the north, "and at last settles at north-east."

It follows from these facts, that during the north-east monsoon the Red Sea is filled with water, which it discharges during the south-west monsoon; and, that the alleged greater elevation of the waters of the Red Sea, above those of the Mediteranean, is but temporary and periodical. The period of the year at which the French engineers made their geometrical survey of the Isthmus of Suez, ought to be known and considered, and a mean elevation taken between their admeasurement, and that which would be the elevation of the Red

Sea at the opposite period of the next monsoon, before the result of their survey could be assumed as fact, which, even if it were so verified, would not be at all applicable to the two oceans at the Isthmus of America. For, besides the foregoing differences between the physical circumstances of the Red Sea, and the sea of the Antilles, there is another local peculiarity of the sea on the Pacific coast of the American Isthmus. The waters of that ocean are gradually accumulated towards the south-eastern extremity of the Isthmus, especially at the south side of the bay of Panama, near the entrance of the gulf of St. Michael, by certain prevailing currents which attend upon the regular southerly trade-wind of the coast of Peru, and the north-westerly trade-wind of that of Mexico, and by the violent south-west winds called Tapayaguas, which, Humboldt says, prevail in August and September at Nicaragua and Guatimala.

The united effect of the currents caused by the almost perennial and opposite winds, considering the conformation of the coasts on which they act, is probably an adequate counterpoise for the possible, but slight accumulation of water on the Atlantic coast of the Isthmus, from the causes before mentioned.

The question of relative elevation is there-

fore limited, for the present, to the difference between the local rise of the tides on each of the opposite coasts of the Isthmus; but the preference that may be due to any particular route for a ship-canal, might be, in some degree, influenced by the difference between the local rise of the tide at different places on the same coast.

There is very slender, and by no means exact, information upon the tides of the Atlantic coast of the Isthmus, along which they rise so little, and are so often controlled by local and temporary winds, which are but occasional exceptions to the regular trade-wind, that little attention has been given to them. But detailed accounts of the tides of the Pacific coast of the Isthmus are extant in the works of the older writers.

It appears from those authorities, that the rise of the tides increases along the shores of the Pacific in the direction from Mexico to Darien. Dampier says, that "at the port of Angels, "which is on the coast of Mexico, between "Acapulco and Tehuantepec, the tide rises "about five foot;" that at the island of Sacrificio, which is nearer to Tehuantepec, "the "sea riseth and falleth five or six foot;" "at "Ria Lexa, the tide rises and falls eight or "nine foot:" "in Nicoya river they rise to "ten or eleven foot;" and he adds, that "on

"the coast of Peru they don't rise so high," which is a collateral proof of the local accumulation of water on this coast of the Isthmus. He says further: "At the Pearl Islands in the "bay of Panama, the tide rises and falls not "above ten or eleven foot on a spring, at the "southernmost end of them, which is almost "opposite to the gulf of St. Michael, and not "above twelve or fourteen leagues from it;" and that "the tide in the gulf of St. Michael "rises and falls about eighteen foot." In his discourse on tides and currents, he says, "eighteen or twenty foot;" and adds, "neither "do the tides ebb and flow so much any where "as in the gulf of St. Michael." It is also remarkable that, "at the river of Guayaquil," as he observes, "the tide rises sixteen foot," which shows the commencement of a decrease in the height of the tides towards the coast of Peru, where he had before said that the tides do not rise so high as in Nicoya river. This circumstance is confirmatory of the local and gradual accumulation of water on the southern shores of the American Isthmus, along which, it appears, the tide of flood comes from the northward and westward. In like manner, it would probably be found, that the tide of flood along the coast of Peru comes from the southward.

It is true, that Dampier assigns special reasons for the local accumulation of tide in the gulf of St. Michael, which he deduces from the conformation of the gulf, and of the rivers that flow into it. But those reasons do not controvert the increasing series of heights in the tide along the whole coast of the Isthmus, though they may adequately explain the great difference of height, above noticed, in the short distance between the Pearl Islands in the bay of Panama, and the gulf of St. Michael; because he says, "yet there (at the Pearl Islands) it "flows more than it does at or near Panama, "or at any other place in the bay, except just "at the mouths of rivers, by two or three foot."

It appears to be unaccountable, that we should find Dampier, in another passage, stating that within the point of Garachina, which is the exterior southern limit of the gulf of St. Michael, "there is four fathom at low water; the tide "riseth here eight or nine foot:" but this assumed height is probably an accidental error,* as Funnel, who accompanied him, says, "At point Garachina, at the entrance of the "gulf of St. Michael, the tide runs five knots "and a-half an hour: it rises and falls three "fathom;" thus confirming Dampier's other

* This supposed error led to the note in page 8, which may be deemed superfluous.

statement of eighteen feet, which he has deliberately reasoned upon, and which may therefore be considered as the more correct.

The excess of this local rise of the tide at the gulf of St. Michael, being equal to thirteen feet more than the rise of tide near Tehuantepec, would be a material consideration in case of intersecting the Isthmus of Darien with a ship-canal. Because that difference of the elevation of the sea would be sufficient to fill, at every tide, reservoirs large enough to give an ample and perpetual supply of water to a ship-canal of one level across that Isthmus, without requiring any assistance from the waters of the Atlantic Ocean, in case the two seas should be found to be nearly equal in mean elevation, or that the Atlantic should prove to be the lowest.

A slight observation upon Doctor Franklin's theory of tides is relevant to this topic. He observes in substance, that the tide in its proper nature is a wave, and not a current, which he illustrates by stating, that the water which makes full tide at Philadelphia is not the same water that causes full tide at the mouth of the river Delaware, because it could not have ran from the sea to Philadelphia, during the few hours of flood tide, without forming a tremendous torrent or inundation. It is certainly true that

the tide of the ocean is, in its main character, a wave, and not a current; but, this corrollary should, perhaps, be added to Franklin's theory, namely, that the waters which first obey the attractive influences to which they are subject, contribute some portion of their volume to the elevation of adjoining waters in regular order; although that contribution is of very limited extent, because time is not allowed for its more enlarged operation. This contribution of water is manifest upon every coast that is subject to tides. At such places the tide is obliged to compensate in velocity, for its inability to rise and fall in a mass without progression, by assuming the character of a current, that it may encircle islands, penetrate inlets, and retreat from them within the period limited by those attractive influences.

The currents that are so produced continue to run, according to the nature of fluids, for some time after the cause of them has passed on, and ceased to operate locally; and thus they accumulate water in particular places. Hence it is, that the tide often rises higher and later in deep gulfs, and in the estuaries of large rivers, than the true ocean tide does at their entrances, or on the adjacent coasts.

It is possible that the gradual difference in the heights of the tide of the Pacific, along

the southern shore of the great Isthmus, at places situated between the gulf of St. Michael and the island of Sacraficio on the coast of Mexico, may be part of a counterpoise or a corresponding declination of the surface of the Atlantic Sea along the northern shore, from the gulf of Darien to that of Mexico, which comprehends part of the course of the current of rotation. It is natural to suppose, there may be a degree of descent in that current; such being usually an accompaniment of the motion of fluids. Whether or not there is a descent in the surface of the sea on the northern coast, we are ignorant. If there is, it would proportionably countervail the local power which might in the other case be derived, in the manner suggested, from the greater rise of tide in the gulf of St. Michael, in obtaining from it a continually recurring supply of water for a navigable intersection of the Isthmus of Darien upon one level. It may be an interesting, though a visionary speculation, to observe that, in case such a countervailing descent does exist, the supposed navigable intersection must be supplied from the northern sea, at the risk of opening a door to the philosophical danger expressed by Humboldt: who says, "We "cannot doubt, that if the Isthmus of Panama "were once burst by some similar catastrophe

"to that which opened the columns of Hercules, "the current of rotation, in place of ascending* "towards the gulf of Mexico, and issuing "through the canal of Bahama, would follow "the same parallel from the coast of Paria to "the Philippine Islands." The effect of this opening, or new strait, would extend much beyond the banks of Newfoundland, and would either occasion the disappearance or diminish the celerity of the hot-water river, known by the name of the Gulf Stream.

* Perhaps this should be read descending.

LOCAL PECULIARITIES OF WINDS AND WEATHER OF THE ISTHMUS OF AMERICA.

This section cannot be commenced more appropriately, than by an abstract of so much as relates to the great Isthmus, from the "Discourse "on winds, breezes, storms, and seasons," by Dampier, who amply atoned for the predatory habits of the early part of his life, by the integrity and utility of his writings, which delight and instruct us; because he narrates the incidents of peculiar and secluded modes of life, with truth and discernment, and describes the attractive and important realities of nature with a fidelity and a sagacity that anticipate the deductions of philosophy.

"Trade-winds blow constantly from one "point or quarter of the compass, between 30° "north and 30° south of the equator. Sea-winds "and land-winds differ much from the former; "the one blowing by day, the other by night. "The true or general trade-winds, except just "under or near the line, constantly blow with- "out intermission, but not with equal force, at "all times; neither do they usually blow near "the shore, but only in the ocean, at least "30 or 40 leagues off at sea, clear from any

" land, especially on the west coast or side of
" any continent. For on the east side, the easterly
" wind, being the true trade-wind, blows almost
" home to the shore; so near as to receive a
" check from the land-wind, and oftentimes to
" admit of the sea-breeze, by which it is drawn
" from its course, frequently four or five points
" of the compass. In the north latitude, these
" winds are commonly at E. N. E.; in south
" latitude, at E. S. E."

" The trade-winds which blow on any coast
" are either constant or shifting. Among the
" coasts subject to constant trade-winds, is
" part of the coast of Mexico, which lies near
" east and west from Panama, some hundreds
" of leagues, though not on one point of the
" compass, because of the small points, bays,
" and bendings of the land. According to the
" course of the general trade, the wind should
" be easterly on this coast; but here we meet
" with the quite contrary. For from the lati-
" tude of 10° to 20° north on the coast of
" Mexico, the winds are constantly near the
" west, except checked sometimes with tor-
" nadoes, which do commonly rise against the
" wind. Calms are not usual on the coast of
" Mexico, only after a tornado, as is common
" in other places. The winds shift very little
" on the south side of the bay of Mexico, *i. e.*,

" in the bay of Campeachy. Indeed, there may
" be some small flurts of a westerly wind on
" these coasts, but neither constant, certain, or
" lasting."

" The coasts where winds do usually shift
" are some in the West-Indies, as that part of
" the coast between cape Gratia de Dios, and
" cape La Vera, or Vela chiefly, and the bay
" of Panama in the South Seas; the first men-
" tioned coast, being part of the West-Indies,
" is all that is there subject to change. The
" common trade-wind on this coast is between
" the north-east and the east: this trade
" blows constantly from March till Novem-
" ber, but is often checked with tornadoes
" in the months of May, June, July, and
" August, especially between the river of
" Darien and Costa Rica; but to windward
" there is a more serene air and a brisker wind.
" From October till March there are westerly
" winds, not constant nor violent, but blowing
" moderately—sometimes two or three days or
" a week—and then the breeze may blow again
" as long. These winds are most in December
" and January. Before and after these two
" months, the trade-wind is only checked a
" day or two, near the full or change of the
" moon; and when the westerly winds blow
" longest and strongest on the coasts, the
" easterly trade blows off at sea, as at other

" times. Near cape La Vela, the true trade
" blows within eight or ten leagues off the
" shore when the westerly winds blow on the
" coast, except in a strong north, which turns
" the trade-wind back; and on the Costa Rica,
" and between it and the river Darien, the
" westerly winds, as they are more frequent
" and lasting than towards cape La Vela, so
" also they blow farther off at sea, sometimes
" far as to twenty or thirty leagues from the
" shore. Therefore, ships bound to windward
" if they have far to go, either take the oppor-
" tunity of the westerly wind season, or else go
" through the gulf of Florida, and stretch away
" to the north, till they get into a variable
" wind's way, and then run to the eastward
" as far as convenient, before they stretch to
" the southward again. But if ships have only
" a small way to sail to windward, they make
" use of the sea and land-breezes, making no
" account of the time of the year."

" The winds in the bay of Panama, are, from
" September till March, easterly; and, from
" March till September again, they are S.
" and S. S. W."

" When we are to sail a great way against
" the trade-wind, we must not wholly depend
" on the sea and land-breezes. In such cases we
" have recourse to other helps, such as Provi-

" dence has supplied these seas with; as for
" example—on the coast of Mexico, where the
" coasting trade is westerly, there they run off
" to sea, till they meet the true E. N. E. trade,
" and then stretch away to the northward as
" far as their port: and this is the benefit of an
" open sea."

" To the west of cape Condeseedo, which is
" at the entrance of the bay of Campeachy,
" the trade-wind is at E. N. E., and the sea and
" land-winds do as duly succeed each other as
" on any other coast."

" The sea-winds are as constantly expected
" as the day, in their proper latitudes, and
" seldom fail but in the wet season. They rise
" in the morning, and withdraw towards the
" evening: yet capes and headlands have the
" greatest benefit of them, where they are
" higher, rise earlier, and blow later. Bays,
" contrarily, have the disadvantage; for there
" they blow but faintly at best, and their con-
" tinuance is but short."

" Land-breezes are quite contrary to the sea-
" breezes; for these blow right from the shore,
" but the sea-breeze right in upon the shore,
" whether the shores lie east, west, north, or
" south: and as the sea-breezes do blow in the
" day and rest in the night; so, on the contrary,
" these do blow in the night and rest in the

" day, and so they do alternately succeed " each other; and commonly where the land " winds are scanty, the sea breezes are but " indifferent neither."

" The briskest land-winds are commonly in " deep bays, in great lakes within land, and " among the ranges of islands or small keys " that lie near the shore; and as for bays, " I shall first pitch on the bay of Campeachy, " which lies between cape Condescedo, and " the high-lands of St. Martin.* Between both " these places, the land-winds are as brisk two " or three leagues off at sea, as at any place I " know. In the middle of the bay, the land " trends from east to west; there the sea-" breezes are at north, and the land-breezes at " south."

" So in the South Seas, the bays of " Panama, &c., have their fresh land-winds and " sea-breezes; but in that bay, and also in all " the bays and coasts of the other or north side " of America already described, they are not " so constant in the wet season as in the dry. " The Samballoe islands, betwixt cape Sam-" blass and Golden island, afford very good " land-winds; indeed, these winds are an extra-" ordinary blessing to those that use the sea, " in any part of the world within the tropics.

* Near this cape the river Guascualco enters the bay.

" The Summasenta* winds, which blow in " the bay of Campeachy, are winds that come " in the months of February, March, and April, " and blow only in that bay between the high " land of St. Martin and cape Condescedo, " which places are about 120 leagues asunder. " They are, properly speaking, neither sea- " breezes nor true land-winds. These winds " are commonly at E. S. E. in the middle of " the bay: they differ both from sea and land " breezes in respect to their duration; for " these Summasenta winds blow three or four " days, sometimes a week, both night and day, " before they cease."

" In the South Seas on the Mexican coast, " between cape Blanco,† in lat. 9° 56′ north, " and Ria Leja in lat. 11° north, which two " places are about eighty leagues distance, " there are winds which blow only in the " months of May, June, and July, called by " the Spaniards Papagayos. They blow night " and day without intermission, sometimes " three or four days, or a week, together; they " are very brisk winds, but not violent. I have " been in one of them, when we went from " Caldera bay, bound to Ria Leja, which blew

* So called from Summasenta, which is near Logwood creek, in the bay of Campeachy.

† There is another cape Blanco, in 3° south on this coast, near Guayaquil.

" at north. Storms within the tropicks, are " generally known to us by some name or other " to distinguish them from other common " winds."

" In the West-Indies there are three sorts " of storms; Norths, Souths, and Hurricanes. " Norths, are violent winds that frequently blow " in the bay of Mexico, from October to " March; they are most violent in December " and January. These winds are not confined " to the bay of Mexico, but there they are " most frequent, and rage with the greatest " violence. They blow strongest at N. N.W.; " sometimes it continues to blow twenty-four " or even forty-eight hours, and sometimes " longer: when the wind continues at the N.W., " blowing only a brisk gale, the Jamaica sea- " men call it a chocolata North.

" When our Jamaica log-wood ships are " coming laden out of the bay of Campea- " chy, in the North season, they are glad to " have a North, for a good North will bring " them almost to Jamaica; neither have any " of our vessels miscarried in any of these " storms that I did ever hear of.

" South winds are also very violent winds. " In what they differ from Hurricanes I know " not, unless in this—that they are more con- " stant to one point of the compass, or that

" they come sooner in the year, than hurricanes " do.

" I was at Jamaica when there happened a " violent South. I was afterwards in the bay " of Campeachy, when we had a much more " violent South than this. Souths increase the " tide of flood: in Norths, there is hardly any " discernable flood, and a constant ebbing of " the sea.

" I have said before that bays have a greater " quantity of rain than head lands. The bay of " Campeachy is a good instance of this; for " the rains are very great there, especially in " the months of July and August. The bay " of Panama, also, will furnish us with a proof " of this by its immoderate rains, especially " the south side of it, even from the gulf of St. " Michael to Cape St. Frances: the rains there " are from April to November; but in June, " July, and August, they are the most violent. " There are many small bays also, west from " the bay of Panama, which have their share of " these wet seasons, as Caldera bay, &c.; but, " to the west of that, where the coast runs more " plain and even, there are not such wet sea- " sons, yet many times very violent tornadoes."

Funnel states that the bay of Tehuantepec is much subject to N. and N.E. winds, which at certain times blow very hard.

Dampier thus describes the winds and weather, on the coasts of Guatimala and Panama, during the month of September: "We steered (from "Amapalla) towards the coast of Peru: we "had tornadoes every day till we made Cape "St. Francisco, which, from June to Novem-"ber, are very common on these coasts; "and we had, with the tornadoes, very much "thunder, lightning, and rain. When the tor-"nadoes were over, the wind which, while they "lasted, was most from the south-east, came "about again to the west, and never failed us "till we were in sight of Cape St. Francisco, "where we found the wind at south with fair "weather, latitude 1° north. When we came "in with this cape, we overtook Captain "Eaton plying under the shore. He, in his "passage from Amapalla, while he was on that "coast, met with such terrible tornadoes of "thunder and lightning, that he and his men "were very much affrighted by them."

In his voyage from Quibo to Ria Lexa, he says: "As we sailed to the westward we had "variable winds; sometimes S.W. and at "W. S.W., and sometimes at E. N. E.; but "we had them most commonly at S.W. We "had a tornado or two every day, and, in the "evening or in the night, we had land-winds at "N. N. E. Being in latitude of 11° 20′, by

observation we saw a high hill in the country, " towering up like a sugar-loaf, which bore " N. E. by N.; therefore we stood in N., and " made it plainer; and then knew it to be that " Volcan which is the sea-mark for the harbour " for Ria Lexa.

On leaving Ria Lexa in the month of August, he observes: " Steering to the westward, we " met with very bad weather as we sailed " along this coast; seldom a day passed but " we had one or two violent tornadoes, and " with them very frightful flashes of light- " ning and claps of thunder. These torna- " does commonly came out of the N. E.; " the wind did not last long, but blew very " fierce for the time. When the tornadoes were " over, we had the wind at W., sometimes at " W. S. W. and S. W., and sometimes to the " north of the west as far as N. W." On the same occasion Funnel says: "We had dirty " squally weather, with very hard gusts of " wind from the two Volcans aforesaid (Guati- " mala), with such prodigious claps of thunder " and flashes of lightning, as none of us ever " saw or heard the like." From Cape St. " Francisco to the great island of California, " in latitude 23°, 30′, from April to November " is the dirty rainy season, with hard storms of " wind and prodigious flashes of lightning and

" terrible claps of thunder, which are at the
" worst in June, July, and August.

M. De Humboldt has many miscellaneous remarks on these topics, which occur in his work according to the following order:

" The coast of Nicaragua is almost inac-
" cessible in the months of August, September,
" and October, on account of the terrible
" storms* and rains; and, in January and
" February, on account of the furious N. E.
" and E. N. E. winds, called Papagayos. The
" port of Tehuantepec, on the Isthmus of Gua-
" sacualco, is not more favoured by nature;
" it gives its name to the hurricanes which
" blow from the north-west.

" A very serious inconvenience is common
" to the eastern coast and to the coast washed
" by the great ocean, falsely called the Pacific
" Ocean; they are rendered inaccessible for
" some months by violent tempests, which
" effectually prevent all navigation. The north
" winds (los nortes), which are north-west
" winds, blow in the gulf of Mexico from the
" autumnal to the spring equinox: these winds
" are generally moderate in the months of
" September and October. Their greatest fury
" is in the month of March, and they some-
" times last to April.

* " Called Tapayaguas: they blow from the south-west."

"The western coast of Mexico is of very "dangerous navigation during the months of "July and August, when terrible hurricanes "blow from the south-west. Even in the fine "season, from the month of October to the "month of May (verano de la Mar del Sur) "the tranquillity of the Pacific Ocean is "interrupted on this coast by impetuous "winds from the north-east and the N. N. E., "known by the names of Papagallow and "Tehuantepec. The latter, which may be "merely the effect, or rather the continuation "of the north wind of the Mexican gulf, "renders the coast of Solinas and la Ventosa "almost as inaccessible as that of Nicaragua "and Guatimala, where violent south-west "winds prevail during the months of August "and September, known by the name of "Tapayaguas."

"The south-west winds are accompanied "with thunder and excessive rains; while the "Tehuantepec and Papagallos* exert their "violence during a clear and azure sky. Thus, "at certain periods, almost all the coasts of "New Spain are dangerous for navigators."

On the subjects of this section much useful information is contained in the nautical memoir

* "The Papagallos blow from Cape Blanco de Nicoya (lat. 9° 30') "to l'Ensenada de S. Catharina (lat. 10° 45')."

annexed to Captain Hall's journal already quoted.

The following are the relevant passages:

"From what we saw and heard, it appeared "to be essential, on working into Panama, to "keep on the eastern side, where the wind is "moderate, the water smooth, and there is no "current; whereas, on the western side, the "breeze is too strong, there is a short sea, and "generally a drain of current setting out to sea-"ward."

"On the south-west coast of Mexico, the fair "season, or what is called the summer, though "the latitude be north, is from December to "May inclusive. During this interval alone it "is advisable to navigate the coast; for, in the "winter, from June to November inclusive, "every part of it is liable to hard gales, torna-"does, or heavy squalls, to calms, to constant "deluges of rain, and the most dangerous light-"ning; added to which, almost all parts of the "coast are at this time, so unhealthy as to be "abandoned by the inhabitants. At the east-"ern end of this range of coast, about Pa-"nama, the winter sets in earlier than at San "Blas, which lies at the western end. Rains "and sickness are looked for early in March at "Panama; but, at San Blas, rain seldom falls "before the 15th of June; sometimes, how-

" ever, it begins on the 1st of June, as we ex-
" perienced. Of the intermediate coast I have
" no exact information, except that December,
" January, and February, are fine months every
" where; and that, with respect to the range
" between Acapulco to Panama, the months of
" March, April, and half of May are also fine:
" at all other times the coast navigation may
" be generally described as dangerous, and on
" every account to be avoided.

" From December to May inclusive, the pre-
" valent winds between Panama and Cape
" Blanco de Nicoya are North-west and North-
" erly. From thence to Rio Lejo and Sonsonate
" North-east and Easterly. At this season, off
" the Gulfs of Papagayo and Tecoantepec there
" blow hard gales, the first being generally
" North-east, and the latter North. These, if
" not too strong, as they sometimes are, greatly
" accelerate the passages to the westward: they
" last for several days together, with a clear
" sky overhead, and a dense red haze near the
" horizon. We experienced both in the Con-
" way, in February 1822. The first, which was
" off Papagayo, carried us two hundred and
" thirty miles to the W. N. W.; but the gale
" we met, on crossing the gulf of Tecoantepec,
" was so hard that we could show no sail, and
" were drifted off to the S. S. W. more than

" a hundred miles." In sailing from Sonsonate to Acapulco, which is to the north-west, Captain Hall says, " If, when off the Gulf of Te-" coantepec, any of the hard breezes which go " by that name should come off, it is advis-" able, if sail can be carried, to ease the sheets " off, and run well to the westward, without " seeking to make northing; westing being, at " all stages of that passage, by far the most dif-" ficult to accomplish. On approaching Aca-" pulco, the shore should be got hold of, and " the land and sea breezes turned to account."

REMARKS ON THE LOCAL PECULIARITIES OF THE WINDS AND WEATHER OF THE ISTHMUS OF AMERICA.

The authorities which are quoted in the last section, show that each coast of the American Isthmus is provided by nature with peculiar winds, besides the land winds and sea breezes that are common to all latitudes within or near the tropics. Almost all of those peculiar winds enable a ship to clear the land, from positions adjacent to the proposed routes, notwithstanding the uniform courses of the trade winds on those coasts are unfavourable to that purpose. Local facilities seem to be even specially dealt out to every part of each coast in proportion to its necessities. This is remarkably the case on the Atlantic coast, where, from the comparatively limited extent of the sea, and from the usual course of the trade wind being between the North-east and the East, those local facilities are of the utmost importance. For example, Dampier says, "The (general) winds shift very little on the south side of the bay of Mexico, "i. e. in the bay of Campeachy;* there may be "sometimes some small flurts of a westerly

* This bay receives the river Guasacualco, which has its source in the Isthmus of Tehuantepec.

" wind, but neither constant, certain, or last-
" ing." We accordingly find that the bay of Campeachy, besides having, according to the same authority, " land winds as brisk two or " three leagues off shore, as in any place I " know," is distinguished in February, March, and April, by local winds called " Summascuta " winds, which blow at E. S. E. :" by " Norths, " which blow from October till March, chiefly " at W. N. W., N. W., and are strongest at " N. N. W," (Dampier says, " A good North " will bring a ship almost to Jamaica,") and by " Souths, which blow about June, " July, or August, and right off the shore on " that coast."

The great bay that runs in to the southward, between Cape Gratia de Dios and Cape la Vela, and which receives the river of Nicaragua, and waters the eastern shore of the Isthmus of Darien, affords, according to Dampier, " more " varieties of winds and currents than any other " part of the West Indies. The common trade " wind on this coast is between north-east and " the east. This trade blows constantly from " March till November, but is often checked " with tornadoes in the months of May, June, " July, and August, especially between the " river of Darien and the river of Costa Rica. " From October till March there are westerly

" winds, not constant or violent, but blowing " moderately, sometimes two or three days, or a " a week, and then the breeze (the trade) may " blow again so long. These winds are most " in December and January: before and after " these two months, the trade wind is only " checked a day or two near the full and change " of the moon. On the Costa Rica, and be- " tween it and the river Darien, the westerly " winds blow as far as to twenty or thirty " leagues from the shore." This last mentioned bay, and also that of Campeachy, are adduced by Dampier as examples that " the " briskest land winds are commonly in deep " bays, and among great ranges of islands, and " small keys that lie near the shore;" and he instances "the Samballoe islands near Golden " island," on the coast of Darien.

The Atlantic coast of the Isthmus is also subject " to tornadoes, which, from May to " August, check the trade wind on the coasts of " Darien and Costa Rica; for tornadoes do " usually rise against the settled wind." Now those are four of the seven months that intervene between the westerly wind seasons, and therefore tornadoes seem to be a substitute for their absence; but as " tornadoes do not con- " tinue, and are often very violent and fierce, " few commanders endeavour to take advantage

" of the wind that comes from them, except " necessity requires haste;" but it is often done by ships that have good crews.

The Pacific coast of the Isthmus having an open sea, is less in want of those local helps, but it is not unprovided with them. The Tehuantepequer and Papagayo winds, which are so called from the gulfs in which they chiefly prevail, seem to be special provisions of this nature. Although these winds have obtained the reputation of being violent, it seems to be only at times that they become excessive. For Dampier, who was three years in the South Seas, and chiefly upon this coast, says of the Papagayos, that "they are brisk winds but not violent;" that " they blow in May, June, and July," and that he was in one of them when he went from Caldera bay to Ria Lejo, which blew at north. He does not describe the Tehuantepequers, but Funnel says, they are north and north-east winds, which, at certain times, blow very hard; and it may be inferred that both are safe winds, as they blow off shore, and enable a ship not only to clear the land, but to make westing, which Captain Hall shews to be the principal difficulty on that coast, in consequence of the coasting trade wind being westerly.

Dampier says, " The winds in the bay of " Panama are, from September to March, east-

" erly, and from March to September again " they are at south and south south-west. " This bay has also fresh land winds and sea " breezes; but there, and also in all the bays " and coasts of the other or north side of Ame- " rica, they are not so constant in the wet sea- " son as in the dry." The entrance of the gulf of St. Michael partakes of the local winds which prevail in the bay of Panama; and as it completes this summary view of the local winds, it may be manifest from it, that both the coasts of the Isthmus of America have considerable facilities for navigation.

ON THE CLIMATE AND DISEASES OF THE ISTHMUS OF AMERICA.

SOME of the preceding quotations contain a few sentences upon these topics, which were suffered to retain their original positions, partly to prevent the connexion of the passages to which they belong from being broken, and partly to exhibit reasonings thereon, with reference to the climate and diseases, as obstacles necessary to be overcome at particular places, before any endeavours to construct a ship-canal in a line with those places could be attempted with any chance of success.

Dampier, in describing the towns of Santa Maria and Schuchadero, says, that the latter "stands on the north side of the open place at "the mouth of the river of Santa Maria, where "there is more air than at the mines, or at "Santa Maria town, where they are in a man-"ner stifled with heat for want of air.

"I have said before, that bays have a "greater quantity of rain than head-lands. "The bay of Panama will furnish us with a "proof of this by its immoderate rains, espe-"pecially the south side of it, even from the "gulf of St. Michael to Cape St. Francis: the

"rains there are from April to November; but "in June, July, and August, they are most "violent."

The same author, after giving a description of a distemper which proved fatal to above thirty of his crew, and which he attributes to bad water, adds, "I have observed, that in hot "countries land-floods, which pour into the "channels of rivers about the season of the "rains, are very unwholesome. For when I "lived in the bay of Campeachy, the fish were "found dead in heaps on the shores of the "rivers and creeks at such a season, and many "we took up half dead; of which sudden mor-"tality there appeared no cause, but only the "malignity of the waters draining off the land "through thick woods and savannas of low "grass and swampy grounds, with which some "hot countries abound."

Upon the climate of that part of the west coast of the Isthmus of Darien, adjacent to the gulf of St. Michael, Wafer says, "The country "all about here is woody, low, and very "unhealthy, the rivers being so oozy that the "stinking mud infects the air. The sides of "the gulf are every where surrounded with "mangroves growing in wet swampy land." Of the Isthmus of Darien generally, he says, "The weather is much the same here as in

"other places of the torrid zone in this latitude, "inclining rather to the wet extreme. The " season of the rains begins in April or May; " and during the months of June, July, and " August, the rains are very violent. It is very " hot also about this time, whenever the sun " breaks out of a cloud; for the air is then very " sultry, because then usually there are no " breezes to fan and cool it, but it is all glow- " ing hot. About September the rains begin " to abate, but it is November or December, " and it may be part of January, ere they are " quite gone; so that it is a very wet country, " and has rains for two-thirds if not three quar- " ters of a year. Their first coming is after " the manner of our sudden April showers, or " hasty thunder showers, one in a day at first: " after this two or three in a day; at length a " shower every hour, and frequently accom- " panied with violent thunder and lightning, " during which time the air has often a faint " sulphurous smell where pent up among the " woods. After this variable weather, for " about four or six weeks, there will be settled " continual rains of several days and nights, " without thunder and lightning, but exceed- " ing vehement, considering the length of " them; yet at intervals between these, even

" in the wettest of the season, there will be
" several fair days intermixed, with only tor-
" nadoes or thunder showers, and that some-
" times for a week together. These thunder
" showers cause usually a sensible wind which
" is very refreshing, and moderates the heat:
" but then this wind shaking the trees of this
" continued forest, their dropping is as trouble-
" some as the rain itself. The coolest time
" here is about our Christmas, when the fair
" weather is coming on. The hills from which
" the gold rivers fall, near Santa Maria, are
" barren towards the top, and bear short
" shrubs scattered here and there. The woods
" of this country are not the same on the tops
" or sides of the hills as they are near the sea;
" for on the drier and more rising inland coun-
" try the woods are rather a large forest of
" timber trees, or a delightful grove of trees of
" several kinds, very large and tall, with little
" or no underwood; and the trees are placed at
" such a distance from each other, as that a
" horse might gallop among them for a great
" way and decline them with ease. But on
" the sea coast, where the soil is often swampy
" drowned land, especially near the mouths of
" rivers, the trees are not tall but shrubby, as
" mangroves, brambles, bamboes, &c. in a con-

" tinual thicket, so close set, that it is a very " difficult matter to work one's way through " these morasses."

In respect of the climate and diseases incidental to the Isthmus of Panama, there appears to be a discordance between the statements of the old and the modern writers.

Dampier says, that, " Panama enjoys a " good air, lying open to the sea wind. There " are no woods nor marshes near Panama, but " a brave dry champion land, not subject to " fogs or mists."

Wafer nearly agrees in this general description of the scite of Panama. He says, " between " the river of Cheapo and Panama, the land is " low even land; most of it is dry, and covered " here and there with short bushes. The town " is surrounded with savannas, gentle flat hills " and copses of wood:" but he adds, " the " place is very sickly, though it lies in a coun- " try good enough; yet it is healthy in com- " parison with Portobello." Of the last-mentioned place, De Ulloa observes, " The heat " is excessive, originated by the situation of the " town, which is surrounded with high moun- " tains, without any interval for the winds."

Walton has urged the unhealthiness of the damp and heated climate at this Isthmus, as one of the greatest obstacles to the opening of

a canal across it, and has stated that the climate of Cruces is infinitely more healthy than that of Panama. He says "Disease is a barrier "against settling on the Isthmus to improve "it, and that persons who have withstood "every other climate, there become languid; "and although the negroes appear fat and "hearty, and are possessed of personal strength "to bear the heaviest burthens, yet want alone "impels them to work."

M. De Humboldt has the following passage on this division of the subject. "For fifty "years back, the vomito (black vomit of "the yellow fever) has never appeared on any "point of the coast of the South Sea, with "the exception of the town of Panama. It "is situated on an arid tongue of land destitute of vegetation; but the tide when it falls, "leaves exposed, for a great way into the bay, "a large extent of ground, covered with *fucus* "*ulvæ et meducæ;* the air is infected by the "decomposition of so many organic substances; "and miasmata, of very little influence on the "organs of the natives, have a powerful effect "on individuals born in the cold regions of "Europe, or in those of the two Americas. "The causes of the insalubrity of the air are "very different on the two coasts of the Isthmus. At Panama, where the vomito is en-

" demical, and where the tides are very strong,
" the shore is considered as the origin of the
" infection. At Portobello, where remittent
" bilious fevers prevail, and where the tides are
" scarcely sensible, the putrid emanations spring
" from the very strength of the vegetation. A
" few years ago, the forests which cover the
" interior of the Isthmus, extended to the very
" gates of the town: the salubrity of the air
" has considerably increased since the governor
" gave orders for clearing away the wood in the
" neighbourhood. Of all places where the man-
" chineel and the mangel vegetate with vigour,
" the most unhealthy are where the roots of
" those trees are not constantly covered with
" water."

Respecting the country, at the mouth of the river Guascualco, in the Isthmus of Tehuantepec, Dampier says, " It was in the wet season " when Captain Rives and Captain Hewett " made an expedition in canoes from the island " Trist to the river Guasickwalp, and there " landed their men; but the country was so " wet, that there was no marching, neither was " the water high enough for a canoe."

Robinson states, that, " Along the coast of " Oaxaca (which includes Tehuantepec) the " climate is destructive of health, but the " greater part of the province, and particularly

" the mountains of Misteca, are famed for " their pure and salubrious air."

" The Indians of Tehuantepec are noted for " activity and beauty."

On the climate and diseases of that part of the Isthmus of Nicaragua, which is adjacent to the proposed route by the towns of Leon and Ria Lexa, there is some special information which shows that those two places, though only about twenty miles apart, are the very reverse of each other in respect of salubrity.

Dampier says, " We landed and marched to " the town of Ria Lexa or Rea Lejo, which is " about a mile from hence. This town stands " on a plain by a small river. It is a pretty " large town, with three churches and an hos- " pital that hath a fine garden belonging to it, " besides many large fair houses, that all stand " at a good distance one from another with " yards about them. This is a very sickly " place, and I believe hath need enough of an " hospital, for it is seated so near the creeks " and swamps, that it is never free from a noi- " some smell. The land about it is a strong " yellow clay, yet where the town stands it " seems to be sand."

" Our men, who had been very healthy till " now, began to fall down apace in fevers; I " rather believe it was a distemper we got at

" Ria Lexa, for it was reported that they had " been visited by a malignant fever in that " town; we having at this time near half our " men sick, and many were dead since we left " Ria Lexa."

On the nature of the same sickness, Wafer, who was surgeon of one of the ships, thus writes: " We set out (from the harbour of Ria " Leja) with three other vessels in our com- " pany, but our men growing very sick when " we were got out to sea, we put into the gulf " of Amapalla. There we lay several weeks at " a small island, on which we built huts for " our sick men, whom we put ashore. In our " four small ships, we had then above one hun- " dred and thirty men sick of the spotted fever, " many of whom died; yet though I attended " them every day, I escaped the infection."

The report on the climate of the city of Leon is an extraordinary contrast with that of Ria Lexa. Gage, who travelled in these parts, (and who, Dampier says, has written candidly, excepting one story), recommends the city of Leon to the world, as the pleasantest place in all America; and calls it " the paradise of the " Indies:" to which Dampier adds, " indeed " if we consider the advantage of its situation, " we may find it surpassing most places for " health and pleasure in America, for the coun- " try about it is of a sandy soil, which soon

" drinks up all the rain that falls, to which
" these parts are much subject. It is encom-
" passed with savannas, so that they have the
" benefit of the breezes coming from any
" quarter, all which makes it a very healthy
" place."

Humboldt observes, " The valleys of Pa-
" payago are among the hottest and unhealthy
" places of the earth."

Robinson says, " The climate of Costa Rica,
" which adjoins Nicaragua, is not deleterious
" like the provinces of Choco and Panama.
" It is the most salubrious of all the tropical
" regions. The finest race of Indians are
" found here, and the soil is fertile."

The Columbian navigator contains the following quotation from Alcedo: " The fort of
" San Juan (of Nicaragua) is placed on a
" rock, and though small, it is strong enough
" to protect the entrance. The usual gar-
" rison consists of one hundred men, besides
" sixteen of artillery, forty musketteers and
" twenty militia. Here the climate is un-
" healthy, as it rains almost perpetually, and
" every two years, or soner if demanded by
" the governor, there is recruited in the capital
" a company of fifty men to replace those who
" die." Upon which it observes, " This violently
" contradicts what has been said of the com-
" parative healthiness of the situation; but, as

" it is a plain and not an alpine country like
" the Isthmus of Panama, it is probable that by
" thinning the woods and draining the marshes
" (events naturally connected with the pro-
" jected canal), this evil might be remedied.
" The bite of the snakes is fatal. When the
" British troops were here, they were obliged to
" withdraw by constant maladies; the country
" being overspread with woods and stinking
" marshes, and the rains falling in torrents
" from April to October, with dreadful thunder-
" storms."

A great impediment to communication between the coasts and the interior of the Isthmus of America, arises from the exuberant growth of mangrove and bamboo trees, in swampy ground, which Humboldt and others consider as one of the causes of insalubrity. They are thus described by Wafer:

" Mangrove trees grow out of the water
" both in islands and the main, rising from
" several roots like stilts entangled one among
" another. The roots, or stumps, appear some
" feet above water, rising from a pretty depth
" also from under the surface of it, and at
" length they unite together, arbour-wise, into
" the body of a lusty tall tree of a foot or two
" diameter. There is scarce any passing along

" where these trees grow, the roots of them are
" so blended together.

" Bamboos grow here, but too plentifully,
" like a briar, whole copses of them. The
" branches or canes grow in clusters, 'twenty
" or thirty or more of them, from one root,'
" and guarded with prickles. They render the
" places where they grow almost impassable,
" which are generally swampy grounds, or the
" sides of rivers. They are found mostly on the
" main, the islands having only some few of
" them. The hollow bamboos are on the main
" only."

In the nautical memoir annexed to Captain Hall's Journal, already quoted, is a notice on the climate and diseases of the western coasts of South America and Mexico, by George Birnie, Esq., Surgeon of H.M.S. Conway, which contains the following passage respecting the Isthmus.

" The third division, extending a distance
" of nearly seventeen hundred miles, from
" Payta to the entrance of the gulf of California,
" forms a perfect contrast with the second.
" All this humid and burning coast has alter-
" nate wet and dry seasons, and is clothed in the
" most luxuriant vegetation, which approaches
" to the water's edge. The mean temperature

" may be called 82°. Mangroves, avicennias,
" and other shrubs, flourish abundantly along
" these swampy shores; and their intertwining
" roots form retreats for molluscœ, and an
" infinite variety of shell-fish and insects.
" Places of this kind are very deleterious to the
" human constitution. The heat and humidity
" of the air increase the development of
" diseases in two different manners—by in-
" creasing the irritability of the organs, and
" by the production of miasmata.

" The disease chiefly encountered in this
" tract is an ardent fever, resembling in every
" respect the yellow fever of the West Indies,
" both in the suddenness of its attack, and the
" violence of its symptoms. It yields to pre-
" cisely the same treatment.

" Whenever an extensive commerce shall
" attract numbers of persons from more tem-
" perate latitudes to this last division of the
" coast, there is no doubt but the yellow
" fever will prevail as extensively, and prove
" as destructive, as it does on the eastern coast.
" The heat and miasms, which only perpetuate
" a general state of bad health and debility in
" the inhabitants, will act upon these robust
" strangers with great violence and rapidity.
" The inhabitants of this coast invariably re-
" move, in the winter season, from the shores

" to the high grounds. The winter, as it is
" termed, is from June to November inclusive,
" during which, violent rains, storms, and ex-
" cessive heat prevail, rendering the neigh-
" bourhood of the sea almost uninhabitable.
" According to Dr. Unanue, 'even black
" ' cattle reared on the mountains cannot sup-
" ' port the temperature of the coast; as soon
" ' as they come down to it they are affected;
" ' they grow stupid and perish with frightful
" ' rapidity; on opening them the liver is
" ' found hardened, as if it had been placed on
" ' coals.' "

REMARKS ON THE CLIMATE AND DISEASES OF THE ISTHMUS OF AMERICA.

It appears from the foregoing authorities that the climate and diseases of the Isthmus of America, especially on the sea coasts, and in low grounds such as would be suitable for a ship canal, are formidable obstacles to the execution of the proposed design.

They furnish evidence, that the climate is very malignant on the western coast of Darien; —nearly as bad at Panama, and the opposite or eastern coast;—deleterious in the province of Choco;—destructive of health on the sea coasts of Tehuantepec, although free from sickness inland;—and comparatively salubrious in some parts of Nicaragua, but with a marked exception of the town of Ria Lexa, and probably of all places in similar situations.

In respect of the state of the population within the proposed routes, it appears that the Isthmus of Darien is so thinly inhabited, that very few labourers could be there procured to perform the necessary works.

Of Panama, Walton says, "it is impossible "to carry any hydraulical plan into effect, "until a new colony of Europeans has been

" sent here, to give activity to the present " inhabitants: the most that could be procured " at present would be about five hundred " labourers, many of whom would not be worth " employing." But it is manifest, that no part of the works could be performed by Europeans.

The province of Choco also appears to be as destitute of labourers, as the Isthmus and neighbourhood of Darien; being in a great degree covered with forests.

The province of Oaxaca, which includes the Isthmus of Tehuantepec, is the most populous of the Mexican provinces.

In Nicaragua, Robinson says, that, " fifty " thousand Indians could be procured for the " purpose, from that and the neighbouring " provinces of Guatimala and Yucatan, if " necessary."

ON THE APPLICATION OF MECHANICAL AGENCY TO A CANAL NAVIGATION ACROSS THE ISTHMUS OF AMERICA.

It is necessary to consider the most efficient means for securing the passage of vessels through the canal, should human efforts finally succeed in forming one, capable of receiving ships of a tonnage adequate to remote commerce. This consideration is material, because in proportion as the facility of transit is increased, so will be the rapidity and magnitude of the returns of capital; and in viewing this part of the subject, it may safely be asserted, that at no period has science ever held forth assistance with so bountiful a hand as it does at this moment. Should a river form any part of such a ship channel, currents and tides would often be adverse; and winds would, at times, undoubtedly oppose the passage of ships, whether the navigation be formed of canal, river, or lake.

To overcome these difficulties, the application of the power of steam, by means of towing vessels, is obviously necessary; but coal, the principal article used in producing steam, has not yet been found either in the Isthmus of

America, or in its immediate neighbourhood. It should be known, however, that large quantities of this material can be procured at Conception in Chili,* which is more than 2,500 miles south of Panama, and at the mountains which overhang Santa Fè de Bogota, the chief town of the republic of Colombia. There is reason to fear, nevertheless, that the want of sufficient means of transit, combined with the inexperience of the natives of South America,† in most departments of mechanical

* "We laid in a supply of coals and fire-wood at this "place. The coals, which were brought for us to the beach, cost "twelve shillings per ton, every thing included. The fire-wood cost "about four shillings per carga of three hundred and sixty billets, "two and a half feet long each, weighing 1,300 lbs." Extracts from a Journal, &c., by Captain Hall, vol. i, p. 346.

† The late Mr. Zea was considered, amongst the Colombians, as a man superior in talent and information to the generality even of the better sort of his countrymen, and was accordingly sent to England, with a view to his obtaining a loan for the service of Colombia. On his arrival in London, he was introduced to a gentleman, to whom we are indebted for this anecdote, who was anxious to obtain some useful information relative to that country, with an intention of serving the independent cause. Amongst a variety of questions, Mr. Zea was asked, if there was a good supply of coal in Colombia, which might be made available for the purposes of steam navigation upon the river Orinoco, and its various tributary streams. In reply, he said, that at Bogota there was plenty of coal, but it was in the hills above the town, and could not be brought down without great labour and expense, upon the backs of mules. The gentleman alluded to immediately took from his pocket a drawing of the inclined planes, the self-moving coal carriages, &c., as used in the conveyance of coals at Sunderland,

science, leaves it a matter of doubt, whether they will, for years to come, be enabled to avail themselves of the many advantages with which nature has supplied their immense territories.

Should any disappointment of supplies of coal from those places be experienced, a sufficiency might be obtained from the stratas of that article which have been lately discovered near the banks of the Missouri, and other rivers tributary to the Mississippi which flows into the gulf of Mexico. But the distance from those stratas to any one of the proposed routes, would probably be also a difficulty in this view of the subject. It is therefore evident, that, unless coal should be discovered in the immediate vicinity of that line which may be ultimately chosen for the proposed canal, little reliance can be placed on the probability of securing, at all times and seasons, a sufficient quantity of this necessary article, for the purposes of steam navigation. Hence it is obvious, that if a mechanical power, not requir-

land, and pointed out to him the methods by which the difficulties he spoke of were removed in this country. Mr. Zea, upon looking at the drawing, said it appeared very fine upon paper, but that he did not believe it could be carried into effect; and, when told, that, if he would make a journey to Sunderland, he would there see the very machinery in action as represented, he expressed his astonishment, and it was with great difficulty he could be induced to believe the fact.

ing a large and continued supply of fuel, yet equal in force to that of steam, could be produced and rendered available for the same purposes, by means both plentiful and of little expense, an extraordinary facility would be given to the navigation across the Isthmus.

The recent application of powers produced by chemical agency to the mechanical arts, forms an era in the progress of knowledge, and proves the applicability of certain properties in nature, which, through neglect of science, have been hitherto inert. Some of the advantages that may be derived from the exercise of these newly developed powers are exemplified in Mr. Samuel Brown's recently constructed pneumatic engine; which, excellent as it appears to be, is but in an infant state, and, like all other young discoveries, is, no doubt, capable of much improvement.

For the information of those who are unacquainted with the extensive capabilities of this engine, it may not be improper in this place to state briefly, that, by a combination of chemical and mechanical agency, which consists in effecting a vacuum within a cylinder by the combustion of hydrogen gas, a power is produced equal in force to that of steam, as used in condensing engines. The common method now in use for generating the gas by which the va-

cuum is ultimately effected, is to consume in a retort either coal or oil; and as the latter is not only portable, but could be procured in large quantities from the South Seas, it is evident that this engine might be used with much advantage on board towing-vessels, constructed for the purpose of accelerating the passage of ships through the canal. Mr. Brown's own ideas upon the utility of his engine go a great way in assisting this conjecture, for he has stated that, "Although the expense of working "a marine engine will be great, as the gas "used for that purpose must be extracted from "oil, or some other body equally portable; yet "even then it will not equal the cost of the "fuel required to propel a steam-boat; and as "a few butts of oil will be sufficient for a long "voyage, vessels of the largest tonnage may "be propelled to the most distant parts of the "world."

It appears also, from experiments which have been made, that certain vegetable substances, some of which are found in large quantities in the Isthmus of America, will produce an abundant supply of inflammable gas; therefore it may be presumed, that the chemical power of this engine would never remain inactive in that part of the world, from a want of the necessary materials.

The inexhaustible science of chemistry appears to have furnished another powerful and available agent, in the discovery of a method of generating oxygen and hydrogen gas in those exact proportions in which they combine, from sea or other water, by means of galvanic electricity.

The discovery of this important auxiliary was made by Sir Humphrey Davy, and is recorded in the first part of the Philosophical Transactions for 1807; but its applicability and usefulness were then unknown, as Mr. Brown's engine was not introduced to public notice until the early part of the year 1824. In No. 43 of the Glasgow Mechanics' Magazine, published in the month of October 1824, is an outline of a plan for propelling vessels by galvanism; and in Nos. 37 and 38 of a periodical work called The Chemist, published in November following, the production, by the means of galvanic electricity, of a mechanical power, and the application of it, when produced, to Mr. Brown's engine, were very ably discussed. It is worthy of remark, that each of the above-mentioned publications treated the subject as one entirely novel, the latter not having been aware of what the former contained: a circumstance that seems to render the practicability of the plan somewhat less doubtful.

But putting aside all recent promulgation of, or discussion upon, theories or inventions, the soundness or utility of which remains as yet unproved, we have authority to state, as a fact, that Mr. Brown had the application of galvanic electricity to his engine under consideration long before either of the publications of October and November 1824, alluded to above, made their appearance, and that he was induced to consider the subject in consequence of Sir Humphrey Davy's experiments made and recorded in 1807.

Should his endeavours to employ voltaic agency in mechanical operations be crowned with success, it is impossible to contemplate the magnitude of its effects.

Since the introduction of the powerful aid of steam, as a means of propelling vessels, much inconvenience, and, in many cases, public as well as individual injury has been sustained, from the washing away of the banks of rivers by the violence of the surge, caused by the action of the paddles upon the water; it is therefore with no small degree of satisfaction, that we are permitted to hint at the probability of a remedy against this inconvenience being soon brought under public consideration by the same eminent engineer.

COMPARATIVE REVIEW OF THE TOPOGRAPHICAL AND NAUTICAL FACILITIES OF THE SEVERAL ISTHMUSES OF TEHUANTEPEC, DARIEN, AND NICARAGUA.

THE selection of these three out of the five routes originally proposed for ship-navigation across the great Isthmus of America, is made on a moral conviction, arising from leading facts which appear to be well authenticated, that the other routes, at Panama,* and through the pro-

* In confirmation of the propriety of rejecting this route, the following description of the defects of the port of Chagre is quoted from the Columbian Navigator, by John Purdy, Hydr: 1824:—
"The Penon (a great rock, on which stands the castle of San Lorenzo), to the N. E., with Punta Arenas, to the S. W., form the mouth of Chagre river, which is two cables' length across where widest, and one and-a-half where narrowest. The mouth narrows between the Penon and a bank which extends out from Arenas' point to the distance of a cable's length. To the south of the Penon there are two and-a-half to three fathoms of water; the same depth continues, with little variation, half a mile up the river. At ninety-two English fathoms west from the castle of Lorenzo is the shoal named Laja, which extends seventy fathoms from north to south, *and is rock with very little water on it.* It is very dangerous either to enter into or sail out of Chagre river, and a passage can be effected only by very manageable vessels which do not draw more than twelve feet water. Both operations must be performed with a fair wind, for otherwise the current of the river, and the various eddies it forms, from the opposition of the Penon, Laja, and west shore, will carry vessels on one or other of those dangers."

vince of Choco to the river Atrato, are incapable of being made navigable for ships from sea to sea, and devoid of such ports as would be requisite to receive vessels at one coast, and let them depart at the other, with ease and safety at all times. Similar reasons for excluding the Isthmus of Tehuantepec from this comparative review are so strong, that it seems like a departure from principle to admit that route into a comparison with those of Darien and Nicaragua; but the recent decree of the Congress of the States of Mexico, which authorizes the President to receive tenders for opening a navigable canal across the Isthmus of Tehuantepec, without specifying whether for ships or barges, calls for a reconsideration of the subject. The concurrence and assistance of a government, enjoying political estimation and pecuniary resources, would be so important in any extensive design, that it becomes a duty to grapple closer with the inquiry by entering into details respecting Tehuantepec, at the same time with the other two selected routes.

Humboldt states, in effect, that the canal of communication between the two seas, which Cramer affirmed could be made, without locks or inclined planes, through the transversal valley to the south of the village of Santa Maria de Chimalapa, would unite the Rio de Chima-

lapa and the Rio del Passo, and would be only six leagues in length. Hence it appears, that only by uniting those rivers could the canal be said to be between the two seas, and that from the very moderate length of the proposed canal, considerable portions of the beds of those rivers would form parts of the navigation. Humboldt also tells us, that the navigation of the Rio del Passo, which discharges itself into the Guasacualco, is extremely difficult on account of the seven rapids or falls which are between its source and the mouth of the Rio de Saravia; and that to avoid those rapids a new port (disembarcadero) was established in 1790, at the mouth of the Rio de Saravia. Although that able writer does not expressly say that the proposed canal must join the Passo above those rapids, yet the necessity of so joining them may be inferred, from his suggesting a survey to determine "whether, by blowing up the rocks with "powder, the beds of the rivers Passo and "Chimalapa can be deepened." The inference thus drawn is fully corroborated by the fact, that the proposed canal, if only six leagues in length, could not extend from the Rio Chimalapa to the new port at the mouth of the Rio de Saravia. This appears from Humboldt's statement, that Cramer and his associate del Corral "reported, that on ascend-

" ing the Rio Guasacualco, *beyond* the cata-
" ract, even as far as the old disembarcadero de
" Malpasso, they were still more than twenty-
" six leagues distant from the shores of the
" South-Sea ;" and, from what is advanced by the same writer, who, after stating the names of the places between Tehuantepec and the new port of La Cruz, says, " they reckon the road " thirty-four leagues." If to these thirty-four leagues be added four leagues, which the same author states to be the distance of the villa de Tehuantepec from the South Sea, the total is thirty-eight leagues; from which, deducting twenty-six leagues, the distance of the old disembarcadero of the Rio Passo from the South Sea, the difference, comprehending that part of the Passo where the rapids are situated, would be twelve leagues, which being double the length of the proposed canal of six leagues, demonstrates that it could only be intended to join the Passo above the rapids.

Unless those rapids are caused by shallows, without any material descent or fall in the bed of the river, the removal of them by blowing up the rocks, as Humboldt suggests, would not improve the navigation of that part of the river Passo; because, if there are descents at those places, the removal of the shallows would pro-

portionably lower the upper level, and decrease the depth of the water above those places, by letting it pass off more freely than at present.

It appears that the river Chimalapa, to which the other end of the proposed canal of six leagues in length would be joined, is also subject to shallows, caused by rocks or sands; as Humboldt likewise hints at the possibility of blowing up the rocks in the Chimalapa, and states, that the sands washed down by that river augment every year both the height and extent of the bar, at the port of Tehuantepec. If there are descents at those shallows in the river Chimalapa, their removal might be followed by the same bad consequences which would probably attend the blowing up of the rocks at the mouth of the Passo. Hence it is manifest, that a collateral canal, with (and not without) locks or inclined planes, would be necessary for enabling a ship to pass that part of the Passo; and probably that another canal for a similar portion of the Chimalapa would be requisite: or else a desague or trench must be cut, from the new port of La Cruz, on the Passo, through the transversal valley, and beyond it, until it would join the Chimalapa on the same level. In length, the desague would, in all likelihood, be near eighteen leagues, supposing the descent in the bed of

the Chimalapa, to be nearly equal to that in the bed of the Passo at its rapids; and the depth throughout would be at least equal to the measurement of the descents of all the rapids of that river, which may have the greatest declination within the specified limits.

Even if those vast works should be completed, ships would still have to navigate about thirty leagues, allowing for deviations of the passage across the Isthmus, a portion of which would be on the rivers Passo and Guasacualco, and the remainder on the river Chimalapa or Tehuantepec.

The navigation of rivers, especially of the nature of those which are here considered, has been shown, in the preceding section of remarks on this Isthmus, to be very inconvenient and dangerous for ships; and also that difficulties exist where a navigation is carried through a narrow passage somewhat elevated, and only a valley in comparison with adjacent heights.

In navigating rivers, the streams of which are not alternated by tides, ships can rarely venture, like barges and small traders, to sail close to the banks, in order to make use of the eddies of their currents to ascend them.* Large vessels, on the contrary, are generally obliged

* Humboldt gives instances which show that even canoes, with the advantage of eddies, only ascend against a current to the elevation of about two feet in a mile. He observes, that, "in the

to keep in the middle of the stream, to ensure themselves a sufficient depth of water; and, in the absence of wind, when the current is of but moderate strength, it can only be stemmed by scientific power.

The prevailing weight of all extant authority shows, that the mouth of the river Guasacualco is not a sufficiently good port; that there is not a port at the mouth of the river Tehuantepec, capable of receiving ships of considerable tonnage, and that there are no means of making the present port better; for Dampier says, "the sea "falls with so great force upon the shore, there "is no landing;" and nautical defects are much more likely to be irremediable, than inland obstacles.

From all these considerations in addition to the before-mentioned reasons, it seems to be an unavoidable conclusion, that the proposed route is unfit, if not impracticable, for a ship navigation that would be adequate to extensive commerce.

It would appear as if those reasons, as well as the arguments here brought forward, were not called for by the opinions of preceding writers; as Humboldt incidentally uses the word "boats,"

"great rivers of South America, canoes ascend without locks "180 leagues against the current, either by towing or rowing, to "the elevation of 300 metres."

and Robinson seems in one passage to qualify his expectation of the fulfilment of the design as a passage for vessels, by proposing a causeway for land-carriage, between the rivers Tehuantepec and Guasacualco. But Humboldt also says of Tehuantepec: "From the authorities which I "have quoted, we cannot doubt that this "point deserves no less attention than the lake "of Nicaragua,"—evidently contemplating a navigation on a great scale; and Robinson observes, that, "although it is deficient in some "of the natural advantages of Costa Rica, still it "possesses others of so important a character, "as to render it almost doubtful with us at "which of the two places the desired communication ought first to be opened."

These passages evidently imply, that, in the opinions of those writers, the Isthmus of Tehuantepec is a practicable route for a ship navigation; and the publicity of those opinions is sufficient to justify this extended examination, which rather shows, that, from so much of its topography as they and other authorities have made known, a contrary conclusion may be drawn.

The comparative facility of opening a ship-canal across the Isthmus of Darien, by intersecting the ridge of mountain with a desague, in

the manner which has been previously pointed out in the section of remarks on this route, is the next portion of the subject under review. The elevation and magnitude of the ridge, and the relative inducements for executing so stupendous a work at this Isthmus, are therefore the proper topics of this comparison of difficulties. Humboldt observes: "Notwithstanding their low-
" ness in Choco and Darien, the Andes traverse
" the Isthmus of Panama, and recover height in
" Guatimala;" but as there has not been any measurement or survey of their elevation or magnitude at this Isthmus, reference must be made to circumstantial description.

Captain Sharp, one of the buccaneers, whose narrative of his expedition across the very line at Darien which it is here proposed to intersect, has been referred to by his associates, Dampier and Wafer, as authentic, says, "I landed at
" Golden Island to attack the town of Santa
" Maria, towards which we continued our
" march till towards two in the afternoon of the
" same day. Next morning by sun-rising, we
" resumed our march and design, being guided
" by several Indians. We travelled all day up
" a steep mountain, till about three in the
" afternoon we got over it, from whence we
" marched about six miles farther to a river:
" we pursued our journey along a very bad

" path, being necessitated to wade the river " between fifty and sixty times."

In continuation of the journey, he says, " I " and Captain Coxon, with the canoes, paddled " all day down the falls and currents of the " river. The next day our passage proved " very bad, and we were forced to haul " our canoes over trees that unhappily lay " across the river. We reimbarked early the " following day, and pursued our voyage with- " out any difficulty at all, for we found a clear " river, and a pleasant day's passage of it; " when, about four in the afternoon, we reached " the place appointed for our rendevouz with " the land-party. The Emperor (of the In- " dians) commanded another canoe to go up " another channel of the river in search of them, " where they found them." In the sequel of the narrative, Sharp observes, that the weight of arms, ammunition, and provisions which each of his men carried " was a load for a city " porter."

The facts of this narrative show that there is but one ridge of mountain at that place; that it is a steep mountain; and that the ascent of it occupied his heavily-laden men from sun-rising (which, in that latitude, is always at near six o'clock, with very little twilight), until about three in the afternoon; that is, for nine hours; but

that the descent of it was so easy or short, that they marched, during the remaining three hours of the same day apparently, six miles farther to a river, and also a considerable distance by a very bad path, along the sides of it. The very existence of a river shows that, in marching six miles, they had passed the declivity of the ridge, though there was still a slope in the surface of the ground; because the river was so shallow that they waded it between fifty and sixty times during their descent.

It is evident from these facts, and may be inferred from the probability of the land party having crossed the mountains at an easier pass, that the ridge is, at this Isthmus, not relatively only but positively, of very moderate height and of very limited extent at its base.

If it should finally be determined upon to make a desague, as has been suggested, it must be cut through the lower but still descending tracts of land that are situated on each side of the ridge, and to an uniform depth throughout; if not to the level of the sea, yet certainly to the level at which ample and unfailing supplies of water could be commanded, to admit of the intersection being continued from thence as a canal, with locks to each of the ports on the opposite coasts of this Isthmus. There are

not any *data* for ascertaining the probable slope or extent of the lower tracts of land, and therefore no calculation of the length or depth of a desague, can be made without a survey of the country.

The extreme wetness of the climate of Darien, " in comparison of which the rains of Europe " are scarcely April showers," and which fall during nine months of the year, is an ample guarantee of the sufficiency of the supplies of water that would be yielded by even the small rivers of the higher grounds. There are seven that flow from the west side of the ridge, and have acquired the following names, the Tayra, the Chuquaque, the Savanna, the Congo, the Sucio, the Estero, and the Cupunati ; and two from the eastern side, namely, the Aglatomate and the Aglasenigua.

It must be freely admitted, that the very idea of attempting a work of such magnitude surpasses the ordinary character of human presumption. Language, as yet, scarcely affords a term sufficiently descriptive of so extraordinary an effort. An instance has however been adduced, in the preceding section of remarks upon this Isthmus, of the accomplishment, in a limited but stupendous degree, of a similar purpose by manual labour. If such a project shall be deemed an extravagant proposition, it may be

entitled to indulgence in a review of comparative difficulties; because human resolves are often formed out of conflicting circumstances. The structure of our minds makes it necessary, and even agreeable, to have presented to us opposite plans or pursuits: the very contrast helps the infirmity of our judgment to form a decision.

Leaving the conception of this design open to all the gay and grave, the rash and deliberate comments which it is adapted to excite; the inducements to undertake a work of such magnitude, shall now be considered.

Those inducements are either general or local. The general inducements belong to subsequent sections of this essay. The local inducements to this vast undertaking at Darien, may be said to consist in the following facts and probabilities:—The line of navigation would not be so long as the course of the San Juan at Nicaragua, and it might not exceed a third of the length of the great canal which would be necessary at that Isthmus, if the San Juan should prove to be unnavigable.—There is but one ridge of mountain to be intersected at Darien.—The supposition that there may be a still lower part of the ridge than that at which it was crossed by Captain Sharp and his party.—The great local rise of the tide in the Gulf of St. Michael.—The

continual supplies of river water, that may be obtained for a ship-canal at Darien, in consequence of the extreme wetness of the climate.—Darien is one of the few parts of that coast, which are not subject to hurricanes.—There is a probability that gold would be found in cutting through the ridge of mountain; that metal having been discovered at various times in a neighbouring part of the same ridge, and in one of the adjacent rivers which flow into the Gulf of St. Michael.—And lastly, there being a good port at each coast of this Isthmus, to terminate the extremities of the proposed desague and navigation.

In confirmation of the characters that have been already given of those ports; the bay at Golden Island, which has been mentioned by Dampier and Wafer, is thus described in the Colombian Navigator, under the name of Caledonia Bay. "Punta Ecosces (*i. e.* Scots "Point) is the S. E. point of Caledonia Bay, "the greater islet of Santa Catalina, or De Oro "(gold), being the N.W. Between point and "point the distance is four miles, and the "points lie N.W. and S. E. (N. 40° W., and S. "40° E.) from each other; and in respect to this "line the bay falls in one mile and two-thirds. "In the S. E. part of this bay, is Puerto "Ecosès (or Scottish harbour) which extends

" inward two miles in that direction, and forms
" good shelter. There are various shoals in it,
" but by the plan (of the harbour) any vessel
" may run in, for the depths are 5, 6, 7, and 8
" fathoms of water over a bottom of sand.
" Between Pedras islet to the north, the west
" point of Aglatamati river to the south, and that
" of San Fulgencio to the south-west, is formed
" the Ensanada, or bay of Caledonia, and the
" channel of Sasardi. The bay of Caledonia
" is clean, and has good deep water: the
" greater part of its coast is a beach, and near
" the middle of it disembogues the river Agla-
" senigua. Between San Fulgencio point, the
" great Oro island, Pedras islet, and the man-
" grove land, the channel of Sasardi is formed.
" The south-east entrance of this channel is with
" nine to twelve fathoms in depth on ooze,
" and further in from eight to ten fathoms.

" These harbours are equally sheltered from
" the winds and seas of both seasons, and have
" a good depth of water; but, the channel of
" Sasardi and bay of Caledonia are preferable,
" because you can, with all winds, either enter
" or sail out from them with more facility, and
" less risk, than into or from Puerto Ecosès.
" The north-west mouth of the channel of
" Sasardi has too many shoals to be of
" utility."

The opposite port, on the western side of this Isthmus, is thus described by the same modern authority: "The Gulf of St. Miguel "is formed by the point of Garachine on the "south, and the point of Brava on the north, "making an opening of above eleven miles "wide; it is contracted as you advance with- "in it, by the points of Palino and Lorenzo, "which are only four miles apart. Here, on "the larboard side, you will see the island of "Iguana, to the northward of which the gulf "opens and receives the rivers Congo, Sucio, "Estero, and Cupunati; a long neck of land "here runs out to the southward, beyond "which the channel becomes narrower, and "has several rocks and islands within it: "to the northward is a large island, which "divides it into two passages, and that to the "northward has the deeper water, but that "to the southward, or Bocco Chica, is narrower "and free from dangers. Having passed these "straits, the channel runs in a S. E. half-east- "erly direction towards the river Tayra: here "a narrow and long sandy island lies mid- "channel, having a passage on each side; that "to the south-westward has the deeper water "and is the broadest. The river Tayra then "winds south-eastward towards the little "town of Santa Maria, up to which it is "navigable; near this town it divides into two

" branches, the one continuing to the south-
" ward taking its rise near the Cordilleras, and
" receiving numerous petty streams in its way,
" some of which serve to support a communi-
" cation with the Gulf of Darien. The other
" branch stretches N. W. by N. so far as the
" mountains which run along the northern
" part of the province of Darien; this is called
" the river Chuquinaque, and is navigable by
" canoes. There is also another branch, divi-
" ding from the north-eastern part of the gulf,
" called the river Savanna; this runs up the
" country about N. N. W. twelve or thirteen
" miles to Fort del Principe. The country
" about these rivers is generally low, woody,
" uncultivated and unhealthy."

Time and observation having abated jealousy and enlarged experience, it may be justly said, that the Scotch settlement formed at Darien in the seventeenth century, which gave the name of Caledonia to the bay at Golden Island, was a remarkable instance of the correctness of the information which was then extant upon the local advantages of this part of the American Isthmus. So striking an example of foresight and judgment, ought to stimulate modern zeal to great undertakings, as it enjoys the liberty of applying itself to any pursuit which may promote the interests of mankind.

All difficulties at Darien appear to be concentrated in the intersection of the mountain, and in the malign influence of the climate; but, as it could not be intended, even at Nicaragua and Costa Rica, to execute the works by the labour of Europeans, and, as Indians and Negroes are acclimated, it does not appear that any insurmountable obstacle would be caused by climate at Darien, provided an adequate quantity of free labour could be there procured. On this point, local information is entirely wanting.

The destruction of the woods by means of fire would have a decided effect in rendering the climate less unhealthy; and science would probably furnish effectual methods, that would dispense with human labour in destroying the mangroves and bamboos on the swampy grounds near the sea coasts.

Under these difficult circumstances, it seems but a due observance of impartiality to say, that a ship-canal, adequate to universal commerce, might be made across the Isthmus of Darien.

The comparative review of the local and nautical facilities of the Isthmus of Nicaragua, may be restricted to the navigable character of the river San Juan, and to the means of making

the port of Bocco del Torro, or rather the Bocco del Draco which is another and better entrance to Admiralty bay, available, instead of the San Juan, for the intersection of the Isthmus. Because the practibility of opening a navigation from Lake Nicaragua to the South Sea, either by the Gulf of Nicoya, or by the port of Ria Lexa, has been already examined in its proper section, as fully as the limited degree of authentic information, now extant upon those routes, would admit.

"The harbour of San Juan," says the Columbian navigator, "is formed by a low "island, which makes a bay with the coast. "This island is in a semicircular form, with its "back to the north; Punta de Arena is its "western point; at the east-end, the island is "nearly united to the main land. The bay "within the island is spacious, but incom- "moded by a great shelf on the east and south, "over which there is little water; and this "shelf reduces the anchorage to five cables "length from north to south, and to two and "a half from east to west. At a cable's length "from the island where you ought to anchor, "there is five fathoms water; the lead is the "only and the best guide into the harbour; "vessels in it are securely sheltered, there "being a swell with winds from the north to

" the west only ; but these winds are common " on this coast, from September to the end of " January.

" The mouth of the river San Juan is ex- " actly on the meridian, or true south from " Punta Arenas, distant more than a mile ; " small vessels ascend hence into the Lake of " Nicaragua. The river of San Juan falls by " four mouths or channels into the sea. Its " current is so strong, that the flat-bottomed " boats and canoes which navigate it, are " about nine days in ascending, and but thirty- " six hours in descending, to and from the " lake. The boats are obliged to unload at " three places, probably rapids. The San " Juan in the dry season is narrow, and im- " peded by shoals. To make the San Juan, " it is necessary to be very sure of your latitude, " and at all seasons it is better to make the " land to the north than to the south of it."

If such be the true character of the port and river of San Juan, the following points are established. That the port would not accommodate any considerable number of ships ;—that the river is not either adequate to the passage of ships of large tonnage between the port and the lake, or capable of being adapted to that purpose with a proper degree of safety at all times ;—but, that its waters are amply suffi-

cient to supply a ship-canal on the largest scale.

It is therefore necessary to examine more closely the plan suggested in the preceding section of remarks on this Isthmus, for constructing a ship-canal from the Bocco del Torro to the nearest branch of the San Juan, which would be somewhat more than one hundred miles long. But as it appears that the river itself would require a collateral canal to enable ships to pass its rapids, avoid its shoals, and prevent the delay and danger attending its current at certain seasons, which canal would of necessity be a vast work, not less, perhaps, than fifty or sixty miles in length, it might be more expedient to make but one canal direct from Admiralty Bay to Lake Nicaragua, or to some part of the San Juan above its rapids.*

The last-mentioned line would be about one hundred and fifty miles long, but it might probably be less costly than the two canals that would be requisite according to the first plan; because it would be directed towards the lake, and, by running more inland, it would cross the rivers of the intermediate part of the provinces of Veragua and Costa Rica, nearer to their sources where they are small, and would, there-

* The direction of the canal here proposed, is shown on the map by a blue line.

fore, require fewer, or smaller, or no aqueducts. Those rivers, of which there are many, appear to be extremely well situated for supplying the canal with water throughout its whole line; and proportionably less water would, in such case, be required from Lake Nicaragua or the San Juan for that purpose.

That there is a spacious tract of open country, fit for a canal, between Admiralty Bay and the lake, appears from the following passage in the Columbian Navigator:—"The mountains "are about seven leagues inland: they are "celebrated for their great elevation, and "named the Cordillera de Veragua. They "commence nearly to the south of the river "Coclet, and unite with the Serranea of Salamanca, nearly on the meridian of the Bocco "del Torro, *which ridge ends a little to the "westward of the river Matina.* At the east "end of the mountains of Veragua there is "a gap,* resembling a riding-saddle, which is

* This gap lies between the source of the river Coclet or Cocle, and the sources of the Rio Grande and other rivers, which flow near Nata into the bay of Panama. Humboldt observes that the elevation of the Isthmus of Panama towards Nata has not been sufficiently examined: therefore this gap in the Cordillera de Veragua seems to merit a scientific survey; but the coast of that province is very shallow where the river Coclet or Cocle enters the Carribbean Sea. Further information is much wanted on this part of the American Isthmus.—Vide page 27 for notice of Rio Grande.

"called the Silla (saddle) of Veragua; this is "to the south of the river Coclet, to find which, "you have only to bring the Silla to bear true "south and run in for the shore."

A canal through the open tract of country which is here described as growing wider in its approach towards Lake Nicaragua, would not be subject to those interruptions and dangers which a navigation through the transversal valley at Tehuantepec would be liable to from the gusts and flurries of wind that prevail in the fissures and chasms of high mountains.

Here, therefore, is a practicable route for completing a ship-navigation across the Isthmus, upon a scale adequate to the largest merchant ships. But such immense works, comprehending a canal 150 miles long on the eastern side of the Isthmus, and another from Lake Nicaragua to the Pacific Ocean, which, if Ria Lexa should be the western port, would not be less than 50 and might be 80 miles in length, besides the improvement of the navigation of the lake itself, would require a combination of wealth, labour, and perseverance, that greatly discourages the hope of its execution.

The decision of the question, whether Darien or Nicaragua possesses the best local and nautical facilities for the effectual attainment of this great object, must await the result of scientific surveys of both routes in all their bearings. Each is encumbered with enormous physical, but apparently not insurmountable, obstacles. The mind can scarcely be brought to decide whether a desague cut from the summit to the base of the ridge of mountain at Darien, with the two supplementary canals to extend the proposed navigation to the tide waters of Caledonia bay and the Gulf of St. Michael; the two basins for the entrance and departure of ships; the conduits; the overfalls; the reservoirs; the locks; the light-houses; the piers; the jetties, and the repairing docks;—with the destruction of woods and forests, of mangroves and bamboos, and the forming of banks and causeways in swamps, with water-courses for their drainage, and all the other appendages to the vast design at Darien, would be more practicable and expedient, or rather less impossible, (if the expression may be allowed,) than the two canals of unprecedented magnitude, with similar appendages at Nicaragua, and two pier-harbours within the lake, or, four such harbours, if Lake Leon should form part of the line of navigation.

Even the incidental impediments are sufficient to render the work arduous. The climate at both routes is malignant to Europeans, but chiefly so at Darien. It may be difficult to procure an adequate number of free labourers of colour at Nicaragua; but there are scarcely any to be procured at Darien: they must, therefore, be brought from other provinces. Under these discouragements, the mind is disposed to repel a proposition so bold, and, as many may think, so extravagant as the Darien Desague; and it finds in other canals and in lake-navigation an every-day precedent for preferring works of that description. But the magnitude of the scale of the proposed ship-canals (which together might be 230 miles in length), at Nicaragua, constitutes a new case, and therefore the adoption of novel means at Darien for a novel purpose, may be the most judicious course.

The government of the Central Provinces of America, in which Nicaragua is comprized, has already* given proof of its zeal for the improvement of its territory, and the increase of its population. The government of Colombia, which includes Darien, would probably not be slow in adopting similar measures to promote a design that would connect its local prosperity with that of universal commerce.

* Vide note in page 110.

ON THE COMMERCIAL AND POLITICAL CONSEQUENCES OF INTERSECTING THE ISTHMUS OF AMERICA WITH A SHIP-NAVIGATION.

THE objects attainable by "this mightiest "event, in favour of the peaceful intercourse of "nations, which the physical circumstances of "the globe present to the enterprize of man,"* are too vast either to be foreseen to their full extent, or to be described in detail even as far as they present themselves; but a few of its important and immediate effects may be thus specified.

The saving of near twelve thousand miles of direct distance in the circumnavigation of South America by Cape Horn, exclusive of the great and indefinite deviations which are caused by contrary winds; and the avoiding of great delays and dangers in doubling that Cape, in consequence of obstinate winds and of ice-bergs, during long winter nights in a high southern latitude.

The rapid colonization of the temperate and fertile regions of the western shores of North America,† which would thus be brought

* Edinburgh Review, No. XXVI. January 1809.

† Humboldt says, "The north-west coast of America has a "much higher temperature than its eastern coast, or the coast of "Asia."

within an easy voyage of its eastern shores and of Europe.

The power of making the voyage, out or home, between England and China in about eighty or ninety days, at all seasons, and consequently, of affording increased facilities for trading with Japan and the whole Indian Archipelago.

The rapid advancement of the British Colonies at New South Wales and Van Diemen's Land, and of the British trade with them, in consequence of a similar facility in making the voyage out or home at all seasons, and with expedition.

A great extension of the South-Sea fisheries, by the saving of time and expense that would result from shortening the voyage many thousand miles.

The civilization and increase of the inhabitants of the islands in the Pacific Ocean, all of which would become commercially connected with Great Britain.

A rapid improvement in the trade and population of Mexico, Guatimala, Colombia, Peru, and Chili, especially by the aid of scientific power in their coasting-trade, and an increased demand in those States for British and European productions.

A certain means of affording relief on the

recurrence of that scarcity which M. De Humboldt says "almost periodically desolates Mexico," and which also frequently occurs in Peru and even in Chili, by supplies from Europe, the eastern coasts of North America, New Holland, and Van Dieman's Land, as any quantity of tonnage could, on the removal of the barrier, be readily obtained for those direct voyages.

New products would become available to satisfy the wants that would attend the general increase of wealth and population.

The sciences and mechanic arts would be extended and diversified.

The characters of nations would be assimilated by intercourse, and by institutions derived from each other.

The same spirit of active commerce that now covers the Atlantic would be extended to the coasts and islands of the Pacific Ocean, which, at no distant period of time, would present a splendid scene of communities rising into existence, knowledge, and social order.

ON THE ARRANGEMENTS NECESSARY TO EFFECTUATE THE PROPOSED DESIGN.

THE main impression of the foregoing authorities upon a mind intent on the adequate execution of this design, may be stated to be, that, although the physical conformation of either the Isthmus of Darien or that of Nicaragua may admit the completion of the project to be within the grasp of combined exertions, yet that it would require a nation's wealth, and a nation's moral and political influence to remove local obstacles,—to supply local deficiencies by works of gigantic magnitude,—and to appease the jealousies of local and other governments, that they may concur in granting the novel immunities which would be requisite to confer on the navigation the privilege of giving a free passage at all times to the merchant-ships of every nation.

It is objected by Humboldt that, on the completion of the design, "every nation would be "dependent on the masters of the Isthmus and "of the canal;" and he has observed that, "should a canal of communication be opened "between the two oceans, great changes

" would be effected in the political state of " eastern Asia." "This neck of land, the barrier " against the waves of the Atlantic ocean, has " been for many ages the bulwark of the inde- " pendence of China and Japan."

To obviate those and other causes of jealousy and apprehension, Robinson has suggested that, " Should the work be undertaken, let it be " executed on a magnificent scale; and when " completed, let it become, like the ocean, a " highway of nations, the enjoyment of which " shall be guaranteed by them all, and which " shall be exempt from the caprice or regula- " tions of any one kingdom or state."

There would, no doubt, be great difficulty in obtaining the concurrence of all the governments of Europe, to the establishment of so novel a species of universal sanctuary within the territories of any of the new states occupying the Isthmus of America. Even if this desirable concurrence could be obtained, such an institution would require that the local government should concede to an association of individuals certain portions of its territory, harbours, and waters, with privileges which would in effect curtail its power, but which would amply remunerate that government for the cession.

It is probable that the condition upon which such a cession of territorial rights and privileges

could be obtained, would be on the terms of committing the local administration of the ceded district to a tribunal constituted by a mixed commission, similar to that now existing between Great Britain and some other nations for the prevention of the slave-trade.

The institution of a local tribunal, so just, so elevated, and so comprehensive, would form a moral era in the history of mankind.

It would perhaps be less difficult to induce the new-born governments of America to co-operate in these extensive views; for Humboldt sagely observes, that, "in the epocha of a nascent civilization, gigantic projects are much "more seductive than more simple ideas of "easier execution."

Yet why should not the elder governments seize this opportunity of manifesting high sentiments in favour of universal peace, justice, and commercial intercourse? The ancient Egyptian, Hindoo, and other nations, have left stupendous monuments of combined and daring exertion. Shall then the expanded minds and unbounded resources of modern nations, in science and in wealth, leave no memorial on the earth's surface of their united capabilities, or of the sacrifice of their partial interests to the establishment of even one local example of international and perpetual peace?

No extension of geographical discovery can ever lessen the importance of opening such a flood-gate for universal commerce. It never would fall into disuse. It would combine in its execution, advantages and facilities which never can result from a discovery of the long-sought, and still vainly-sought, North-West and North-East passages to the North Pacific Ocean.

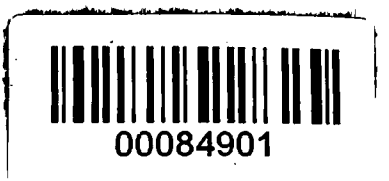
The completion of the work upon those principles, by European means, would be some atonement to America for the desolations which followed the discovery of that immense continent. It would be an achievement, which, for grandeur and utility, would be second only to the enterprize by which those vast regions became known to Europe.

FINIS.

LONDON:
PRINTED BY COX AND BAYLIS, GREAT QUEEN STREET.

ERRATA.

Page 8, note, 2d line—*See* should be *Sec.*
23, line 22..... *Quito* ..... *Quibo.*
54, ... 25..... extends .... extend.
76, ... 7..... Corta ..... Çosta.
89, beginning of line 11; the word *of* is omitted.
105, line 14, he.... should be the.
152, ... 3, Sacraficio ..... *Sacrificio.*
162, ... 18, Frances ..... Francis.
181, ... 18, Guascualco .... Guasacualco.


00084901

Digitized with financial assistance from the
Government of Maharashtra
on 07 April, 2016